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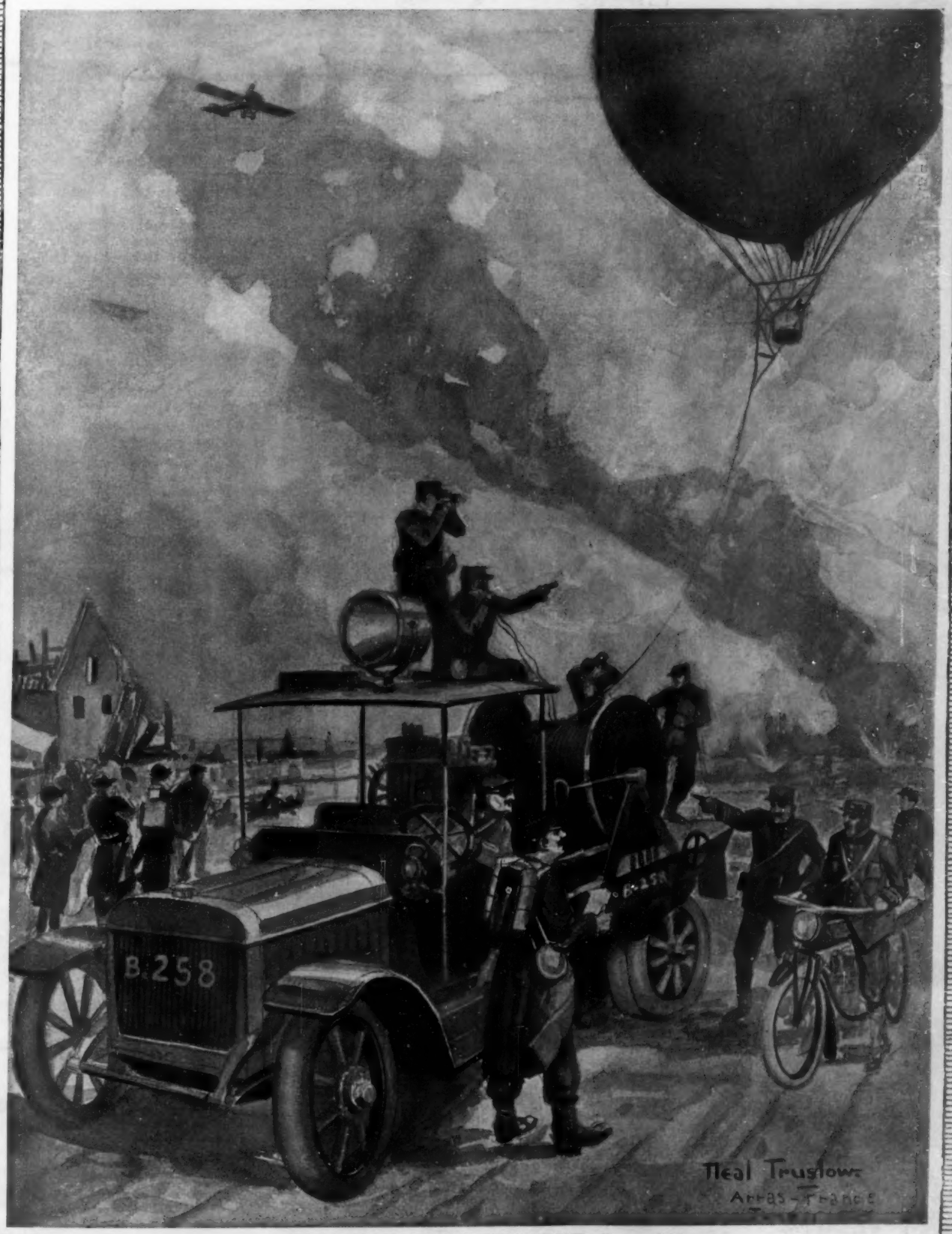

A CAPTIVE BALLOON ON THE FRENCH FRONT.—[See page 181.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contribution will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Greatest Technical Blunder of the War

IF the Kaiser were to ask a member of his Great General Staff what was the most serious technical blunder that has been committed by any of the belligerent powers during the present war, it is quite conceivable that he would answer, "The failure of Great Britain to place cotton on the contraband list." If he did not make this answer offhand, it is certain that upon mature consideration and taking into consideration the absolutely controlling part played by cotton in the manufacture of propellants, he would name this omission on the part of the British government as the greatest piece of short-sighted folly of the war.

The present conflict has resolved itself into a war of artillery—the universal propellant for modern artillery is smokeless powder—the invariable and major constituent of smokeless powder is cotton—and hence the absolute necessity for an enormous, continuous, and unfailing supply of cotton, if modern warfare is to be waged upon the stupendous scale which marks the present European conflict.

The Imperial German News Bureau is minimizing the importance of cotton, by sending broadcast the statement that such is the skill and resourcefulness of the German chemists that they have found a way to manufacture smokeless powder without the use of cotton; but this august authority (quite inadvertently, of course) has omitted to state that this substitute (in which use is made of wood pulp and if need be of straw) is a propellant of decidedly inferior strength and quality.

And what does that imply? Nothing more nor less than this—that the existing range tables are at once rendered quite valueless, and the existing sights on all the thousands of guns, big and little, in the German and Austrian armies would have to be changed, if wood pulp or straw powder is substituted for cotton powder. There is one other way by which the loss of velocity due to the use of a weaker propellant could be compensated for, and that is, by sending all of the artillery back to the gun factories and re-boring the powder chambers, so as to admit of the use of larger charges. But the making of such radical changes in the existing artillery would be a vast undertaking, even in the piping times of peace—attempted in the height of a life-and-death struggle, whose operations extend over a battle front of nigh upon 2,000 miles, it would be simply suicidal.

Cotton, then, is just now absolutely the most important material element in the conduct of the gigantic struggle in Europe. It has been so, in fact, from the very day when war was declared. That the British government should have failed to grasp this fact is simply amazing. Had they but brought together the gun maker and the chemist, and had they secured the expert advice of such a man as Prof. Ramsay at the very outset of the war, they would have realized the vital importance of cotton, and it would have been placed at once on the contraband list. A Ramsay would have told them that any possible German substitutes would give lower velocities and more or less uncertain results, and the gun-maker would have told them it was too late to readjust range tables and gun sights, or to enlarge the powder chambers of the fifteen or twenty thousand field and siege pieces which the central powers have produced in anticipation of and during the present war.

The Germans realized, long ago, that since the war would be a war of artillery, cotton in unlimited abundance would be an indispensable element of success. They failed in their expectations of making the war short and decisive. On their defeat at the great battle of the Marne, they set about gathering together every possible pound of cotton that could be brought over their borders. The principal sources of cotton supply are found under the British flag and in our own Southern States. The British supply, of course, ceased at once; and, failing to appreciate the importance of cotton, and not wishing to subject a great neutral power to unnecessary inconvenience, Great Britain during the past year has permitted large supplies of American cotton to enter Germany through the neutral States. The British have now definitely placed all cotton on the contraband list, and in the discussion of this measure they point to the fact that the United States Government made cotton contraband in 1861, on the ground that in the absence of specie it constituted the principal purchasing power of the Confederacy. The British claim that the ground which they themselves now take, namely, that cotton is a fundamental necessity of war, is even stronger than that taken by the United States in its action in 1861.

The cause of the Allies has undoubtedly suffered as the result of the considerate attitude which they have taken on this question hitherto. The situation is well put by Lord Sydenham, when he says: "We desire above all to preserve the most friendly relations with the great kindred people with whom we have been at peace for a hundred years; but they must realize perfectly that we and our gallant allies are fighting for our lives, and they will not forget that in their supreme crisis we placed no difficulties in their path and that the men and women of Lancashire endured privation in order that the Union should be maintained."

The National Academy of Sciences and the National Government

THE Government of the United States has gradually built up the most imposing congeries of scientific institutions that ever existed under official auspices in a single country. Nearly every branch of science is now represented—and in most cases conspicuously so—in a Government bureau, e. g., geology in the Geological Survey; astronomy in the Naval Observatory; physics (*inter alia*) in the Bureau of Standards; chemistry in the Bureau of Chemistry; meteorology and seismology in the Weather Bureau; and so forth. The Smithsonian Institution represents a wide range of scientific activities. As all of these institutions have their headquarters in Washington, that city has become the scientific metropolis of the country.

That the National Academy of Sciences is also an adjunct of the National Government is a fact that apparently has not been fully realized either by the public or by the Government itself. How does this happen? That it is greatly to the advantage of Congress and the various executive departments to have at their immediate disposal the advice of the foremost scientific men of the country, especially organized for giving such advice, is so obvious that one cannot but be struck by the contrast between the conspicuous position occupied by the scientific institutions mentioned in the foregoing paragraph and the quasi-obscurity that has heretofore shrouded the academy.

There are several reasons for this obscurity, and one of these undoubtedly is the fact that the academy has no real headquarters. It will acquire tangibility (so to speak) only when it has a building of its own in Washington, to focus alike its own activities and the attention of the public. A suitable building would serve not only as a focus, but also as a nucleus, around which would grow up many new and useful undertakings. Of those that can now be foreseen, we may mention exhibits illustrating the history of science in America; lectures, with illustrative experiments, similar to those given at the Royal Institution in London; and the proper shelving of the academy's library, which is now packed away and useless.

It is urgently desirable that Congress provide such a building for its accredited scientific advisers, as a first step toward enabling the academy to play a more active part in public affairs. Probably one of the most important tasks that might appropriately be entrusted to the academy would be that of supervising, in some measure, the heterogeneous scientific bureaus of the Government and bringing about a greater degree of coordination among them. Moreover, we believe the academy should be permitted to offer advice to the Government of its own initiative, rather than merely give advice when requested.

It is a startling anomaly that the Government, having had about the best "gray matter" in the country at its unlimited disposal for more than half a century, has made very little use of it.

Military Surgery

JUST now, fifty years after Lister's epoch-making demonstration of antisepsis, surgeons are discussing which should be the method of choice in operating on the wounded in battle. Should it be antisepsis or asepsis? Lister's idea was to destroy or render harmless the septic, that is, the toxic or poison-producing germs which got into wounds, by introducing into those wounds antiseptic, germicidal substances, such as carbolic acid. Since his day the method of asepsis has been developed, by which germs are prevented from getting into wounds at all. Asepsis is quite feasible in our magnificently equipped and managed hospitals, where the skin over the region to be operated on is first rendered sterile, and where the air of the operating room, the surgeons' and nurses' hands, the instruments, towels, sponges, dressings and everything else that might conceivably come in contact with the patient's body, has likewise been made germ free.

But such sepsis is impossible in the present "civilized" warfare. The rule is, no armistice for the removal of the dead or the wounded. So the dead remain until they putrefy and themselves breed pestilence; while the wounded lie for days in the wet and manured fields (manure is the most congenial habitat of the tetanus bacillus), and in the semi-flooded and ordured trenches. Besides the lockjaw bacillus and the streptococcus (the pus-producing germ), and the many other pathogenic organisms surgeons have ever to contend with, the unprecedented abundance of high power explosives has also produced wound conditions ideal for the gas gangrene bacillus to thrive in.

Only at night, and not always even then, can the stretcher bearers go about their merciful work; and the motor ambulances are under the added difficulty that their lights draw the enemy's fire. The artillery range is now so extensive that the Red Cross on the field hospital has become just a joke. Under such circumstances, then, asepsis has just had to go by the board, and "Back to Lister" is now the slogan. For how is the frequent side-swiping wound, where half the face, including the eye, is torn away, to be rendered aseptic? Nor is it possible to make a wound area consisting of sloughing tissue, blood, mud, masses of muscle ripped from their tendons and extruding through ragged skin, "butterfly fractured" bones, severed nerves and vessels and bits of dirty uniform—to make such a wound visibly clean, let alone microscopically clean, that is, germ free. Working in any available barn or railway station, however insanitary, in any town hall or church, in a "hospital" fitted up for two hundred, into which it is sought within the hour to crowd a thousand, the best the surgeon can do—he and his never enough to be extolled ally, the nurse—is to paint the skin around the wound with antiseptic tincture of iodine, wash the wound with carbolic or bichloride or permanganate of hydrogen peroxide solution, trim about with knife saw and artery forceps, pack the wound with antiseptic dressings; and then to inject emetin (to check possible blind hemorrhages), anti-tetanus, anti-streptococcus and other serums preventive of wound infections.

And what, even so, are the results? The wounded man, if he does not expire in the field or the trench, if he can find place on the surgeon's operating table (or board, or door removed from its hinges), is having better than twenty-four chances in twenty-five of living to tell of his glorious wounding, and to honor the surgeon who patched him up. For here is the record: The wounded returned practically at once to the front, 54.5 per cent; sent away for convalescence, 24.5 per cent; under more or less prolonged treatment in hospital, 17.4 per cent; dismissed from the army as incapable for further service, 1.46 per cent; dead, 3.48 per cent.

A marked difference, by the way, has been found in the healing of the wounds of soldiers and sailors. The latter, with wounds fully as bad, recover with wonderful promptness; while soldiers, from even slight hurts, have died by reason of the wound contaminations here considered. The sailors' wounds are submerged an hour or more in cold sea water. Wherefore Sir Almroth Wright and English colleagues of his have had introduced into military surgery the hypertonic salt solution (5 to 10 per cent common salt plus one half of 1 per cent citrate of soda), and with considerable success. Here is in point of fact a reversion to the old methods of "drawing out an inflammation"; for this solution determines a flow of lymph and blood serum into the wounded parts, so profuse that both germs and their toxins are either neutralized or carried off in the subsequent dressings.

Stocking Japanese Waters with American Trout.—The United States Bureau of Fisheries reports that it has recently, at the request of the Japanese Government, sent 100,000 eggs of the rainbow trout from its California hatchery to Kobe, Japan, to be used in stocking the waters of Hiogo Province.

Electricity

Electrical Prosperity Week.—In order to focus public attention upon the progress of electricity to show what it has done for humanity and how indispensable it is and should be in practically every walk of life, the Society for Electrical Development has inaugurated an Electrical Prosperity week, from November 29th to December 4th next. This plan is meeting with hearty co-operation in every branch of electrical industry and promises to be a wonderful success. Suggestions have been sent out to manufacturers, dealers, contractors, central stations, electric vehicle associations, public schools and women's clubs, and booklets have been prepared on "How to put on an electric parade," "How to put on a demonstration," and kindred subjects.

New Luminous Receiver for Postal Telegraphy.—Noting that when the voltage drop in a Wehnelt interrupter is above a certain value, and the anode becomes luminous. L. H. Walter has made use of this phenomenon as a receiver for photo-telegraphy. It has been shown that when copper, tin and other metals that do not exhibit the valve effect are alloyed with aluminium, a very good luminosity is produced. An alloy known as Duralumin, which contains from 3.5 to 5.5 per cent of copper and 0.5 per cent of magnesium was therefore tried. In a plate of insulating material several thousand Duralumin plugs were inserted and kept moist with electrolyte by means of a sheet of crape hung from a tubular cathode which contained the supply of electrolyte and fed it to the crape. By this arrangement 3,240 elements were provided per square decimeter, any one of which could be illuminated or darkened hundreds of times per second. The degree of luminosity varies according to the voltage used.

Increasing Wireless Range by Kites.—The recent maneuvers in northeastern Massachusetts were of particular interest because of successful experiments by the Signal Corps in maintaining a wireless aerial at a great altitude by means of kites, and thereby increasing the efficiency of an ordinary field radio set from 6 to 16 times. At the invitation of Adjutant-General Cole of the Massachusetts Volunteer Militia, Samuel F. Perkins, a maker and flyer of man-lifting kites, went to Newbury and experimented with the Signal Corps. As there happened to be fairly strong winds at the time, Mr. Perkins was able to send up a string of kites to a height of 1,600 feet. The messages transmitted from the kite-supported aerial are said to have been received 150 miles away with distinctness, although the field wireless set used would only transmit messages 25 miles ordinarily. The results were obtained because the kites flew so steadily that the aerial was always maintained at a constant altitude. The receiving qualities of the kite-supported aerial were remarkable. The messages were received from the battleship "Georgia" off Newport, and from the government stations at Arlington, Va., and Bermuda. Code messages being exchanged between two British warships out in the Atlantic Ocean were received with accuracy. Further experiments by the United States Government and Marconi officials are now being conducted, and it is expected that in a short time the range of sending from an ordinary field wireless set will be increased.

Method of Making Selenium Cells.—In making up a selenium cell with platinum wire wound about a slate or other base, one of the operations is to properly coat the melted selenium on to the support, and this can be readily done provided the needed precautions are observed. Supposing the cell has half an inch square of active or coated surface, the wire-wound support is heated over a Bunsen burner in order to put on the coating. To avoid overheating, which would volatilize the selenium, only a moderate heat with small flame should be used. A good method of guarding against unequal heating, due to air currents, is to use a sheet metal strip a few inches wide, part of which serves as a flat base, while the rest is bent around in a semicircle to make a partly inclosed oven, this being suitably mounted over the flame. When the cell is well heated, break off a small grain of selenium and allow it to melt upon the cell, then spread upon the surface. Spreading is conveniently done by a short and narrow flexible knife blade of thinnest sheet iron well polished and mounted in a long wood handle. The selenium, which has about the consistency of sealing wax, is easily spread over the surface, and the excess is lightly scraped off with the knife, which, of course, should not have a sharp edge. Care should be taken not to drop any of the material on the metal plate where it might volatilize, or to allow any of it to run upon the rear part of the cell, for although this would not absolutely spoil the working, such part is not acted on by the light and the effect would be to make the cell less sensitive in proportion to the inactive surface. When coated, the cell is removed with a pair of pliers and cooled very quickly by placing it on a metal block, tile or other surface. Should the entire surface not appear brilliant, but have a dull gray hue, remelt on the plate and the vitreous state will be restored. With proper precautions, the finished cell will have the selenium in the vitreous state. It must then be annealed.

Science

The United States Bureau of Fisheries has, during the fiscal year ended June 30th, 1915, set a new record in the output of its hatcheries, the total for the year amounting to 4,300,000,000, or about 250,000,000 more than in the previous year.

"Poudre de Riz."—A number of the preparations sold under this name have been examined by Mr. Charles H. La Wall, who reported at the last meeting of the Pennsylvania Pharmaceutical Association that very few of them contain rice starch, while many consist largely of more or less harmful mineral ingredients. Mr. La Wall also called attention to the fact that under the current interpretation of the term "drug" the Federal, as well as many of the State food and drug laws, do not apply to preparations sold as cosmetics.

A Subject Index to Scientific Journals.—With its issue of July 3rd, the *Athenaeum* (London), published, in a separate pamphlet, the first instalment of a subject index to scientific and technical journals for the period January–June, 1915, including especially material on the technological aspects of the war. Any and every well-executed index to current scientific journals is a most welcome addition to our libraries, whether public or private. Several admirable enterprises of this character exist in the United States, but they have been rare in Great Britain.

Use of the Word "Mil" in Pharmacy.—An account of the meeting on June 22nd-24th of the Pennsylvania Pharmaceutical Association, published in *Public Health Reports*, states that the meeting endorsed the action of the revision committee of the Pharmacopœia of the United States in behalf of using the term "mil," in lieu of "cubic centimeter," to denote the thousandth part of a liter. This term is an abridgment of "milliliter," and, according to resolutions adopted by the above-mentioned association, "is well adapted for use as a designation for smaller fractions of liquid medicines."

Stefánsson, the Arctic explorer, has never been heard from since he parted with his supporting party on the ice, north of Alaska, April 7th, 1914. The strenuous efforts of his secretary, Mr. McConnell, to raise funds (estimated at $100,000) for a search for the missing explorer to be made with the aid of aeroplanes—an entirely feasible and highly promising undertaking that would certainly have increased geographical knowledge, even if it did not accomplish its principal object—have been unsuccessful. At least two whaling ships will visit Wrangel Island this month in the hope that the explorer and his two companions may have reached that point.

The Largest Dicotyledonous Seed.—In his recent botanical exploration of Panama, Mr. Henry Pittier discovered a tree known to the natives as *alcornoque*, and to which he has given the name of *Dimorphandra megistosperma*. The species name has reference to the enormous seeds borne by the tree, exceeding in size those of any other known dicotyledonous plant. Mr. Pittier collected some of these seeds over 7 inches long by 4.7 inches broad, growing in pods nearly 10 inches long. The tree is allied to the *mora* of Guiana, and grows to heights exceeding 100 feet. Its wood is said to be better than any other for structures kept permanently under sea water.

Malaria-bearing Mosquitoes in the Philippines.—Messrs. Walker and Barber, of the Bureau of Science at Manila, have recently reported the results of an elaborate investigation carried out in Laguna Province, Luzon, on the transmission of malaria by various species of *Anopheles*. The forms of malaria studied were subtertian, tertian and quartan, and five species of *Anopheles* were investigated. Of these, it was found that *A. febrifer* was by far the most susceptible to infection and showed a relatively high avidity for human blood. If it should prove to be as widely distributed throughout the archipelago as it is in Laguna Province, it must be regarded as the most important mosquito concerned in the epidemiology of malaria in the Philippines.

Methods of Bacterial Analysis of Air.—In the course of some investigations of stable air at the New York Agricultural Experiment Station, Mr. G. L. A. Ruehle has had occasion to experiment with different methods of determining the bacterial content of air, and he reports results of general interest in the *Journal of Agricultural Research*. He found that the particular form of sand-filter aeroscope recommended by the committee on standard methods of bacterial air analysis, appointed by the American Public Health Association, varied in its filtering efficiency from 50 to 100 per cent, apparently owing to the fact that it must be sterilized with steam, which causes caking of the sand-filtering layer. The writer describes a modified form of this instrument that can be sterilized with dry heat, and this was found to retain nearly 100 per cent of the bacteria, with little chance of error. It is relatively cheap, durable, and easy to operate. The method of determining bacterial precipitation from air by means of exposed Petri plates was found to be entirely unreliable, as this method gives a measure of the number of bacteria-laden dust particles, and not a measure of the number of bacteria present.

Aeronautics

Improving Aeroplane Wings.—In patent No. 1,145,013, Edson F. Gallaudet of Norwich, Conn., provides in an aeroplane improved wing construction and control mechanism by which the operator during flight can control the angular positions of the wings as a whole to adapt them to changing conditions, especially as to speed, and can also warp the wings to maintain lateral balance, at the same time permitting the secure attachment and guying of the wings to the body of the machine.

Mufflers and Self Starters.—Although it is obvious that both mufflers and self-starters are not only desirable but practically a necessity on aeroplanes in war service, very little attention has been given to these devices, largely because it is claimed their use diminishes the speed about 3 per cent. Most of this, however, must be attributed to the muffler, which has heretofore been of the automobile type. As there is plenty of space available on an aeroplane, it would appear perfectly possible to fit a muffler that would be far more quiet than those used on automobiles, and creating but a minimum of back pressure on the motor.

A Curtiss Flying-Boat Patent.—In a recent patent (No. 1,142,754) to Glenn H. Curtiss is illustrated what is probably the latest Curtiss flying-boat. Mr. J. H. Colwell, Patent Office Examiner, having special charge of aeronautics, has made several flights in a machine of the character illustrated in this patent. In starting from the water, the boat first dips or rocks forward. When the necessary speed is developed, the rear rudder is depressed and the boat will rock on the step located about midway between the bow and stern before rising, the step being practically under the center of gravity, so that immediately before rising from the water, daylight can be seen below the hydroplane surface, both fore and aft of the center step.

Improved German Air-craft.—The inferiority of the German aeroplane was made quite apparent in the early days of the war, as they were wholly unable to cope with either the French or the English machines in speed or in climbing abilities, and as a result, the Taube flyers have been seen but seldom this year, and when they appeared, they were careful not to venture near the firing lines. Now, however, it is stated that a new type of machine has appeared that is fully equal to anything the Allies possess. Little is known of the nature of the improvements in these new machines, but from their observed evolutions, it is quite evident that they are provided with engines of a power and reliability not heretofore possessed by the Germans, and those who have seen them have been much impressed with their speed and climbing abilities.

Wounded Aeroplanes.—The wings of an aeroplane work surprisingly well when they are riddled with bullet holes. It is usually assumed, says *Prometheus*, that the sustaining power of a plane is proportional to its area, but it is known that the shape is also an important factor, and it is evident that the injurious effect of holes is not proportional to the diminution in area produced by them. The wings of birds are permeable, especially when widely extended. The efficiency of ships' sails is not much effected by holes, and Vassalo in 1894, experimentally proved to his own satisfaction that sails are improved by perforations. Even injuries to the motor of an aeroplane are less dangerous than would naturally be assumed, provided that the pilot retains control of the vessel. He can descend by gliding and can advance nearly four miles in a descent of one mile.

Curtiss Brings Out a New War-plane.—A new Curtiss aeroplane, built especially for war purposes, and capable of carrying three passengers, besides the pilot, was tried out at Buffalo, N. Y., recently, and made a most excellent showing, easily breaking the American records for climbing with passengers, and apparently capable of great speed in ordinary flying. With two passengers an ascent of 8,200 feet was made in twenty-seven minutes, and with three passengers a considerably greater elevation was reached, equally as fast. In this second climb, with a total live load of 800 pounds, a height of 8,300 feet was quickly attained, when the barograph stopped recording. The ascent was continued for another five minutes before the descent began, and those who observed the flight are confident that, with the same load, another 4,000 feet could be accomplished. The American record for height, with two passengers, is 5,187 feet, and the world's record with three passengers is held by an Austrian aviator, who ascended 15,650 feet last year. This new machine is of the tractor type, with the passengers located in a cockpit in front of the pilot, who sits behind the planes. The engine develops 160 horse-power, and the machine is capable of carrying a load of 1,500 pounds dead weight. It is capable of flying at great speed with full load, and it is believed that the requirement of climbing rapidly from the ground with its load has been most satisfactorily met. Its control appears to be very perfect, for it is said that in these tests, the pilot flew at a speed of 94 miles an hour without touching the wheel. Further altitude tests will be made as soon as a barograph of greater capacity is secured.

Weed Killer for Railroad Tracks

THE process of eliminating track vegetation by hand weeding has three strong objections: it is expensive; it does not remove root growth, and is, therefore, temporary in effect; and it disturbs the surface, which causes dust and wash-outs. The process of weed burning is even less permanent in effect than hand weeding, and while less expensive for one treatment, it is apt to be costly in the final result; for the roots are not entirely destroyed and the weeds are actually stimulated by the temporary stunting, and the vegetable ash acts as a fertilizer; furthermore, the danger to surrounding property and right of way is also a drawback.

A third process, that of chemically treating the roadbed, is illustrated herewith. It is claimed for the process that the solution acts as a preservative for the entire track structure, while the permanent eradication of vegetable matter insures clean ballast. The apparatus consists of one or more tank cars fitted with spraying apparatus, for handling the chemical. The equipment is designed to carry a sprinkling load capable of spraying from eight to twenty miles. The speed of operation is from fifteen to twenty miles an hour.

In one case on a track near Gaffney, S. C., 126 gallons of chemical was diluted in 3,024 gallons of water and sprayed on a 12-foot width one mile long. A heavy growth of Bermuda grass, some crab grass, and other vegetation of the common variety were treated and the vegetation killed.

The photograph shows the extension arm of the sectional sprinkler spraying under fifteen pounds air pressure. This arm, when lowered, is supported by a U brace, and when passing obstructions may be raised quickly by means of the chain which is attached to a rod along the body of the tank. The arm may also be elevated to any angle when it is desired to force the mixture out over the sub-shoulder.

Turkey Uses American Motors in War

THE waters of the harbor of Constantinople and the Dardanelles are at present being constantly patrolled by the motor craft of the Turkish government. The accompanying photograph shows four of these fleet, American looking, patrol runabouts in the harbor of the Turkish capital. The boats are 28 feet long, with rakish lines and tumble-home stern, each equipped with a 20-35 horse-power engine installed forward under the half cabin, giving a large and roomy cockpit. The boats have a speed of nearly fifteen knots.

The engines with which these patrol launches are equipped have had an adventurous career. Before the outbreak of the war an American company received a cabled order from its Turkish representatives and distributors, the Chantiers des Constructions Navales de Phanar, for four stock 20-35 horse-power medium duty motors. The motors were intended for use in some new boats the Chantiers de Constructions Navales de Phanar were building for the police administration of Constantinople. They were promptly shipped for their distant destination, but while on their way the war broke out, and the Turkish government saw another use for them. Upon their arrival in the Turkish capital, therefore, the motors were promptly confiscated at the Customs, and put to the use shown in the accompanying photographs, being installed by the engineers of the Turkish War Department.

The Police Department, however, protested at the confiscation, and exerted every effort to have the motors returned. With the interests of their customers in mind, the builders of the engines besought the United States State Department also to endeavor to have the engines returned to the consignee, and the Consul-General at Constantinople made vigorous attempts to accomplish this end. Apparently one of the engines was returned to the Customs for a time, but the photograph shows the part these motors are playing at the present time. As a concrete example of the tremendous value of the small motor craft in patrol work in time of war, the photographs are of exceptional interest. The envelope in which they were contained was open, and it seems likely that the letter which accompanied them had been removed by the censor. The photographs, however, were allowed to find their way to the United States unmolested.

A weed killer at work.

The War's Sick and Wounded

THE amazing preparedness for dealing with the sick and the wounded in the present warfare, especially among the Germans, is manifest in an exhibition which has been opened in Berlin for the education of the public. All that is done by the State and by voluntary efforts for the care and the restoration to health of the wounded and sick soldiers, is here represented; beginning with prophylaxis and first aid to the injured and extending to the convalescent in his home country. The exposition is divided into groups. The first group illustrates the sanitary arrangements for the army in the field. Here one sees the first aid package closed and opened, of which every soldier carries two sewed into his coat, and which are intended for the first care of the wound by the wounded man himself, or by a comrade; also the set of articles that are to be carried in the pocket, the set for the whole group, the cavalry case, the pocket case of bandage material, the instrument case for the hospital, a field Roentgen car, models of hospital tents and barracks. How the wounded are cared for is shown by a large relief map of a battlefield: one sees the surgeons lying on the abdomen under fire, bandaging the wounded; and then still on the battlefield, the sanitary squad; the transportation of the wounded; the work at the temporary dressing station; the gathering places, and the field and base hospitals. Models illustrate also how the wounded are transported in motor buses, carts and hospital trains.

Another group depicts the medical and surgical work in the navy, as complete as that for the army. A third group exhibits the means of combating infectious diseases in warfare; presents pictures and cultures of the various pathogenic germs; shows the methods of obtaining preventive and curative serums and vaccines; gives tables showing the effectiveness of vaccination against both small-pox and typhoid fever; shows arrangements for disinfection, flying laboratories, tables and charts illustrating the spread of, and the way to guard against, tuberculosis and other serious infections.

There is a department demonstrating the application of the Roentgen rays in the care of the wounded; the work of the dentist in war; the technique of nursing in all its manifold details; the organization of nursing in warfare, the ways of occupying and amusing the sick. And there is a department showing the provisions for the crippled in warfare; illustrating by pictures and models how, with proper care and training, a relatively large number of those who have been maimed can be rendered measurably self-supporting. Thus, a man who has lost both his feet and both his hands, is yet capable of dressing and washing himself without help, of eating, writing and working at a lathe in a turner shop.

Some Problems in Stellar Photometry

JOEL STEBBINS of the astronomical observatory of the University of Illinois, to whom the National Academy of Sciences has awarded the Henry Draper medal, in recognition of his work on the application of the selenium cell to stellar photography, indicates in the May, 1915, issue of the *Proceedings* of the academy some of the researches which the selenium and photo-electric photometers have made possible.

These very accurate devices may be applied with advantage to the eclipsing variables, which give the only direct clue to the actual diameters of stars. From arguments too technical to reproduce the author concludes that the components of the typical binary star are separated by approximately five times their average radius, revolve in about four days, and have one twentieth the density of the sun. This conclusion is based upon variables found by visual and photographic methods, but abundant work remains for the new photometers, with which the author has found four variables out of eleven spectroscopic binaries tested. Eclipses are not the only causes of light-variation of binaries, and such variation probably occurs in all stars showing rapid changes in spectra.

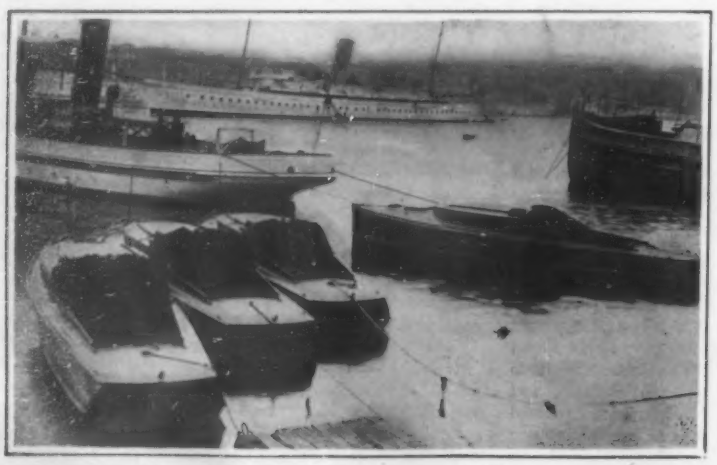
The sun is a variable star because of its spots. The difficulty of making proper allowance for atmospheric absorption may be eliminated by comparing the reflected light of a planet, preferably Saturn or Uranus, with the light of a number of stars.

With the new photometers, furthermore, the light of comet, nebula, star cluster, or other diffuse object may be compared directly with a point source like a star, and we may expect to get a very good measure of the general light of the sky.

Lunar and solar eclipses also present attractive problems. The total light of the corona and its distribution will be easy to determine. The zodiacal light can be measured and any absorption of star light by the zodiacal matter may even be detected at a mountain station.

A Sanitary Corps in the Philippines

A NEW health law, creating a service similar to that of the United States Public Health Service, has recently gone into effect, and provides for the supervision of all matters of sanitation in the Philippines. Several novel features are incorporated in the law, and the powers conferred greatly exceed those possessed by officials in this country, and the practical operation of the service will be watched with interest.

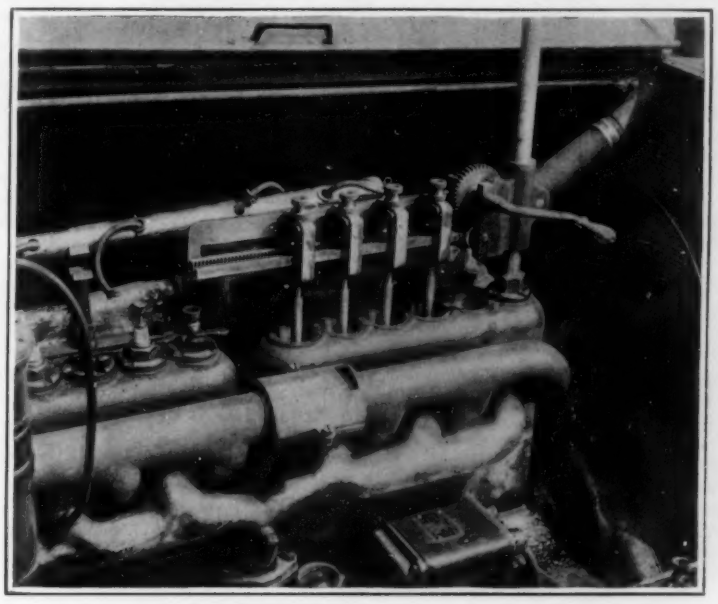


Four American patrol motor boats in Turkish waters.

These American motor boats reached Turkey after many adventures.

Multiple Valve Grinder

A MACHINE for grinding by hand four or six valves of a gasoline motor at once is pictured herewith. The device consists of a standard that is screwed into a spark plug hole in the motor and that bears an arm extending over the valves. On this arm are carried four or six, as the case may be, frames holding a screwdriver shank that has a gear where the handle would be. The bit of each shank engages the head of the valve, while the gear fits in two racks, one on each side of it, extending through all the frames. These racks are pinned eccentrically to the sides of a gear fastened to the operating handle. Turning the handle moves the racks back and forth in opposite directions, and imparts to the screwdriver shanks the oscillatory motion that is so necessary for valve grinding. The pressure on each valve may be regulated as desired, by varying the tension of the spring that presses the screwdriver shanks downward. Each frame has an adjusting screw for this purpose.



A machine for grinding four or six valves.

Safety Spurs for a Railroad Grade

By Harry Chapin Plummer

WITH the completion of notable improvements which the Baltimore & Ohio Railroad has undertaken during the last five years to extend its facilities in the mountain districts, including the laying of third and fourth tracks on the east and west slopes of the Allegheny range, the elimination of tunnels and curves and the reduction of grades to afford a low-grade line from the West Virginia coal regions, it has become possible for the road to handle longer trains of heavier tonnage to the full capacity of the giant Mallet, Mikado, and Centipede locomotives.

As eastbound trains of the road dip over the crest of the Allegheny Mountains at Altamont, Md. (in the extreme western section of that State, which is all but divided from Maryland proper by the triangular wedge of northern counties of West Virginia) they make their way down a winding slope of 2 per cent average descent for seventeen miles to Piedmont, W. Va. The factor of safety in descending this grade has become one of prime consideration, and the solution of the problem is represented in a safeguard unique in engineering practice and that quite overcomes the possibility of lost control.

At two points on the Piedmont grade—at Stricker's and at Bond—switches, known as safety spurs, have been constructed to automatically check the speed of a train which might be going down the hill at an excessive rate, by setting it off of the main track and diverting it to an inclined track, so as to overcome the momentum. These safety spurs effect the protection of the train movement on the entire hill. The switches are 2,650 feet and 2,900 feet long, sufficient to handle regulation trains operated over that section of the road, and they are so constructed as to render negligible the likelihood of derailment.

The safety spur system consists of an interlocked facing-switch in the main track, starting at a specific switch and governed by a time-release which is entirely mechanical and which is operated in one direction by crank motion and toward normal by gravity. The main track is divided up into blocks. The normal position of the switch being set for the siding, the distant signal eastbound operates in two positions only—i. e., from zero to 45 degrees, and indicates to the engineer to proceed with caution when the track circuit between it and the home signal is unoccupied and the main-track switch is normal.

Trains are required to approach the distant signal prepared to stop, and when an indication to proceed is received, engineers know that the main-track switch is set for the safety spur and electrically locked in that direction. If the train consumes a minute or more between the distant signal eastbound and the next signal, the electric lock on the lever of the former is released. It may also be released by using a slow hand-release which opens the controlling distant signal when the latter has been moved from its normal position.

A train passing the first distant signal at twenty miles per hour consumes the required minute in the block and thus automatically releases the electric lever and permits the operator in the tower to reverse and lock the switch and change the signal to a proceed position without bringing the train to a stop. But should a train consume less than one minute in the block, the electric lock will not release automatically and it will then be necessary for the operator to use the slow hand release, requiring two minutes to unlock, during which time the train should come to a stop at the second signal or diverge to the safety spur.

To reduce the cost of construction and hold it to minimum, it was necessary to introduce some curvature into the alignment of the tracks, but in every instance the outer rail was elevated sufficiently to guard against the derailment of trains running at high speed. The safety spur at Stricker's necessitated the removal of 33,000 cubic yards of excavation and the construction of small retaining walls to prevent the slopes of the fill on the spur from encroaching on the roadbed of the main line. At Bond, 25,000 cubic yards of material were excavated and small retaining walls likewise were constructed.

A safety spur for a railroad grade.

The Current Supplement

THE Review of the Advances in General Physics, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2069, for August 28th, 1915, reminds us of a number of important achievements in recent years that are apt to be lost sight of. A topic of which little is seen in print is the paper industry, and the article on the evolution in paper and pulp manufacture will be read with interest, as paper is such an important article in our everyday life. During the heated weather now prevailing the subject of ice appeals to all of us, and the description of the modern methods and ingenious applications of gasoline power to the harvesting of this indispensable material will be of interest to everyone. There is also included in the article valuable information in regard to the hygienic side of the question; and there are several illustrations showing the new machinery. A brief illustrated article gives a great deal of timely information in regard to the details of the quick-fire field guns now being used by the British in the war. The exhaustive article reviewing the therapeutic uses of preparations of the ductless glands is concluded in this issue. In view of the many discussions of the coal-tar dye question, and why America does not produce its own supplies, there is a pertinent article that suggests a very definite answer. Although much has been published in relation to submarines and torpedoes, there are still many questions relating to their practical operation and use that have not been answered. The article in the present issue on this subject gives a great deal of information which the public has been seeking, and several special illustrations greatly assist in a clear understanding of the subject. The economy of fuel is fast becoming a vital topic with all users of power, and methods of securing greater efficiency are of great importance. One of the latest proposals to be investigated, although the idea is a very old one, is that of pulverizing the coal before burning; and investigations are being made to discover a practical method of burning coal in this form. This is an intricate question, and the article on the subject gives considerable information in relation to the problem. Psychological studies of mental capacities and characteristics are attracting the attention of many scientists and thinkers, as these questions have an important bearing on many sociological problems. The article on A New Way to Measure Mental Ability will be found an important contribution on the subject. In every large community the transportation of passengers is a matter of daily importance, and the coming of the "Jitney" has introduced many new problems for solution, involving both public convenience and the position of street railway companies. An article by a specialist in street railway matters in this issue is a very enlightening review of the situation.

What is the Brownian Theory?

REFERENCE is frequently made in scientific papers to "The Brownian Theory," but few people among general readers know anything about it. Probably the quickest and the simplest way to convey a good general understanding of the matter is by citing an example; and the simplest and most comprehensive one that has yet been given is that by Prof. W. D. Bancroft in a recent paper in the *Journal of Physical Chemistry*, as follows:

If we drop a stone into water, it sinks very rapidly; if we grind the stone into coarse particles these sink less rapidly; if we grind the stone into fine particles these sink slowly; if we grind the stone into very fine particles we should expect them to sink very slowly, the rate being a function of the diameter of the particles. This is not the case, however. Very fine particles do not follow Stokes's equation and do not settle at all, because of the Brownian movements which are negligible for coarse particles. We, therefore, conclude that any substance can be brought into a state of colloidal solution provided we make the particles of that phase so small that the Brownian movements will keep the particles suspended, and provided we prevent agglomeration of the particles by a suitable surface film. This is the Brownian motion which can be discerned under an instrument known as the ultramicroscope, which makes visible particles which are invisible in the ordinary instrument.

Wearing Apparel Trademark Case.—The Court of Appeals of the District of Columbia in B. V. D. Company v. Potterf has held that there is no such similarity between the trademark "P. C. G." of Potterf and the trademark "B. V. D." for wearing apparel of the opposer as is likely to produce any confusion in the trade.

Strategic Moves of the War—August 19th, 1915

By Capt. Matthew E. Hanna, Recently of the General Staff, U. S. A.

ONCE more the Balkan States have taken the center of the stage. It was suggested recently in these notes that Russia's best hope of relief from the Teutons closing about her army like a vise, was to be found in the possibility of the Balkan armies joining in the struggle on the side of the Allies. The French-English-Belgian offensive in the western theater is gaining so little headway as to be practically at a standstill. The Italian campaign, which promised so much in the beginning, has accomplished nothing decisive, and the situation in this theater is no more critical than it has been for some weeks. A condition of stalemate still exists on the Gallipoli Peninsula, and a decisive victory here in time to relieve the desperate situation of Russia is not probable. The Russian army must be delivered from the calamity which threatens it, saved from extermination and given time in which to recuperate, and if this cannot be done by the allied forces now in the field, new armies must be formed to aid the Allies, from states heretofore neutral.

This accounts for the fierce diplomatic struggle that has been waged for some weeks at the capitals of the Balkan States—a struggle that surpasses in intensity and the employment of every resource of diplomacy that which was waged at Rome prior to Italy's entering the war. And all the signs point to a victory for one side or the other in the very near future. There appears to be no doubt but what the Balkan States are putting their fighting forces on a war footing and perfecting their arrangements for entering the conflict; Bulgaria has openly avowed her intention of gaining back what she considers her lost provinces and is willing to sell out to the highest bidder; and the cabinet crisis in Greece is a victory for the partisans of the Allies. It would be indeed strange if this group of comparatively small States, so often forced to accept the dictum of Europe, should furnish the weight of arms to turn the wavering balance of war in favor of one side or the other.

The combined armies of these States would be a formidable force, trained in the recent Balkan wars, and led by commanders of known ability. A glance at the map shows how strong would be its strategic position to the south of Austria-Hungary and in the rear of the southern wing of the Teuton line in Russia, which is now in the vicinity of Czernowitz. It could advance through Rumania, supplied by the railway through Bukarest, keep to the east of the Transylvanian Alps and the Carpathian Mountains, and strike the Austrian flank on the Dniester just north of Czernowitz. Or it could advance by Belgrade through the wide gap in the higher mountain ranges directly into the plains of Hungary, threatening Budapest and Vienna, some hundred and fifty miles west of Budapest. Either move would bring instant relief to the Russians. The first would throw the whole force of Balkan arms on the main battlefield in Russia, where it might have a decisive effect on the future developments in this theater. The second would lead the Balkan forces away from the Russian battle front, but would relieve the pressure on the Russians by drawing strong Austrian forces out of Russia for the defense of Hungary. In either case, the plans of the Teutons for the continuation of the Russian campaign would be seriously interfered with, to say the least.

An advance against Constantinople and the rear of the Turkish army on the Gallipoli Peninsula no doubt would also be undertaken, although the opening of rail lines across the Balkan Peninsula for carrying supplies to Russia might make the control of the Dardanelles Straits less essential for the Allies. The capture of Constantinople and the Turkish forces in Europe could not be accomplished without serious fighting, which would draw heavily on the Balkan forces and greatly weaken the army of invasion in Hungary. The Turkish lines west of Constantinople, with both flanks protected by the sea, withstood many desperate assaults in the recent Balkan wars, and Turkish troops withdrawn from Asia would be sufficient to man them for another stubborn defense.

For the Allies to get any great assistance from the Balkan States in the existing crisis in Russia, they must have the active co-operation of the Balkan armies, and that is what they are endeavoring to secure in the diplomatic negotiations now under way. With the Teutons, it is otherwise. To secure a diplomatic victory they have but to induce the Balkans to remain neutral, and if by chance they can persuade them to enter the struggle against the Allies, the Teuton victory is all the greater, and might easily be the prelude to the complete overthrow of the allied forces. In other words, the task of the Allies is much more difficult than that of the Germans in this struggle to gain some military advantage from the condition of unrest in the Balkan States.

The situation is so mixed and the information that reaches us is so meager and probably inaccurate that it is not possible to form anything approaching an accurate opinion of what the final decision of the Balkan States will be. On the surface the indications are that they will either remain neutral or possibly join the Germans. The Teutons apparently have made them promises of territorial and other concessions which meet their principal demands, and ask in return that they shall not join the Allies, and certain privileges such as the right to send supplies across the Balkan territory to Turkey. Whether or not these promises are made good is to depend on the final outcome of the war, and once the Balkan States have cast their lot with the German it is to their interest naturally to see him win, and to make victory all the more certain they might be persuaded to enter the war on the side of the Germans.

There can be no doubt but what the great victories the Germans are winning over the Russians have exercised a tremendous influence at Bukarest, Sofia and Athens and have materially strengthened the hand of the Germans in the diplomatic parleys. At this particular time it is very difficult to pick the winner in the Great War and the Balkan States naturally want to make sure that they choose the winning side. But the German has not only shown them what he can do

Map showing controlling position of Balkan States in southeastern theater of war.

against the powerful combinations opposed to him, but has also backed up his diplomatic negotiations by a show of force by way of warning them of what may happen in their own country if they refuse to accept the German propositions. This is an occasion when diplomacy is no stronger than the physical force behind it, and the German concentration on the Danube frontier of Servia will have its effect on the final decision of the Balkan governments.

This Teuton army is being assembled at the natural doorway between Austria and the Balkans. Along the railroad from Belgrade to Constantinople lies the best and most direct route to the very heart of the Balkan territory. Belgrade is the one point on this frontier that is reached by a network of railroads from the interior of Austria. A German advance from here would immediately carry the war into Balkan territory, and would place the invaders directly on the flank of the Balkan forces if they should attempt to advance through Bukarest to the north. War supplies must also be sent to Turkey, if she is to continue in the war, even if the road to Constantinople must be opened by force of arms.

Can the Teutons find the additional forces necessary to meet this new and formidable foe, if one or more of the Balkan States should declare for the Allies? They are barely holding their own on the Italian front, and probably have reduced their forces on the French front to the absolute minimum. Their Russian campaign has been very expensive in human life, and no doubt has made tremendous drains on their resources of men. The Russian theater is the only one from which they can draw a force sufficiently powerful to oppose a Balkan coalition, and the campaign in this theater is precisely the one they least desire to disturb. They appear to be on the eve of a really decisive victory here, and nothing less than the direct necessity to avoid disaster elsewhere would induce them to jeopardize their triumph. German success in this war depends on their ability to win decisively on one or the other of the two main battle fronts—France and Russia. Their first effort was made in the French theater and failed, and then they transferred the great bulk of their forces to the Russian theater. For nearly four months they have carried on a campaign against Russia unrivaled in intensity by any military operations recorded in history, with but one main purpose in view—the destruction of the Russian army. Should they succeed in this main undertaking, their subsequent operations should be comparatively easy.

With these conditions existing it will not be an easy matter for the Allies to turn the Teutons away from the decisive advantage they have gained over the Russian army. Kovno has fallen, and the way is open for the Germans to cut the line of the Warsaw-Petrograd Railway in the rear of the Russians. The Russian capital is thus uncovered, and, what is of vastly more importance, the Russian right wing is in great danger of being completely enveloped, and the Russian retreat to the eastward of Brest-Litovsk becomes more difficult. Altogether, the capture of Kovno is the gravest disaster that has yet befallen the Russian arms, not even taking into consideration the very large number of heavy guns captured, which is a loss Russia will feel greatly. Before these notes are published Novo-Georgeivsk probably will have fallen, giving the Germans another large quota of prisoners and booty, and freeing the besieging Germany army for the front.

The Plague and the Ground Squirrel

IN California the *Bacillus pestis*, the germ of the bubonic plague, was found to be transferred by the flea from the rat's pelt to that of the ground squirrel. And by reason of this danger the United States Public Health Service instituted a campaign against both these rodents, in which from July to November, 1914, 90 per cent of the squirrels were destroyed over an area of 3,373,146 acres, including 2,000 miles of railway right of way. This work averaged less than 17.4 cents the acre; and the average infestation has been 6.5 squirrels the acre. The result of this work is believed to be the practical elimination of the bubonic plague from the State of California. Apart from disease, ground squirrels have caused great yearly losses and in the most diverse ways: Growing crops have been eaten or destroyed; nursery stock has been damaged; floods, with attending disaster and money loss, have followed burrowing into irrigation ditches and canal banks. Many interruptions in railway traffic have occurred through cave-ins in railway cuts and washouts in embankments, that have had their beginnings through floods, or surface water finding its way through a squirrel burrow to a place where damage could result. Even though there were no washouts, ties and rails subsided where individual burrows and colonies caved in; with resulting increase in maintenance of way charges and repairs to rolling stock and rails. On investigation 21 persons reported over $2,000 saved in repairs to irrigational canal banks; 22 reported an average saving of $99 the person on young trees; where the expenditure per acre in squirrel destruction was 11.2 cents the estimated saving was 34 cents per acre—a return of 300 per cent the first year. Even greater advantages were reported in respect of stored grains.

How the Flow of a River is Measured

IF you see a man leaning over the railing of a bridge intently watching the river, with a telephone receiver at his ear, do not think that he is trying to talk to the fishes or to a diver below the surface. He is probably one of the Government's engineers measuring the amount of water passing under the bridge. This is done by lowering an instrument, known as a current meter, into the water at several points under the bridge to determine the speed of the water and by measuring the depths of the water at the same points.

From such information the flow of the river at that particular time and height can be computed, and when such measurements have been made at a number of different heights the flow of the stream at any height can be determined. Then, if a record of the height of the river is obtained each day from a river gage, the flow for each day can be computed. It was in this way that the information in "Water-Supply Paper 353" was obtained.—*U. S. Geological Survey.*

Captive Balloons on the French Front

By Neal Truslow

CORRESPONDENT FOR THE SCIENTIFIC AMERICAN WITH THE FRENCH ARMY.

MILITARY science develops so rapidly in modern warfare that nothing is so unreliable as fixed ideas, and nothing so unstable as tradition. With military telephones, wireless stations, and long-range guns, chance played a minor rôle in the battlefields of yesterday. To-day, with the addition of aircraft it is almost eliminated. Every move of troops on either side is known at once to the adversary. Batteries may be concealed beneath brush, and trenches be partially covered, but no massing of men can take place along the battle front without knowledge of such action being gleaned by the bird men. This knowledge is immediately communicated to headquarters, a corresponding move is made on the other side, and an attack almost invariably begins by "checkmate" in the matter of forces.

The success of the weapons of the Germans cannot be denied. They have guns in use which the rest of the world had scarcely accepted in theory, and the whole world is aghast at the results of their submarine activities. In the air, however, with the costly and reputedly invincible Zeppelin, they have most signally failed. The raids on London and Paris kill small numbers of non-combatants, it is true, but are costly and absolutely devoid of strategical advantage. When one of these great aerial batteries can be destroyed by an aviator, single-handed, the impracticability and defenselessness of the ponderous gas bag are very easily understood.

France has easily demonstrated her superiority over Germany in navigating the air. Almost every week we hear of the destruction of a Taube, and scarcely less frequently of the loss of a Zeppelin. Her success in aerial scout duty has been more pronounced than that of the enemy, with the result that offensive movements have been anticipated and met so successfully that the French line is slowly but surely advancing.

The work of signaling the position of the enemy, their approach, their retreat, their every movement, from aeroplanes, is most interesting. Yet the height the aviators must maintain to be out of range of hostile guns, and the speed at which they must fly, make the handling of telescopes very difficult, and the necessity of a more effective method of observation imperative.

This need brought about the development of the captive balloon, which was made portable and easy to operate by means of specially constructed automobiles. The automobile required for this purpose is a three or five-ton truck, equipped with every necessary device for the operation and transportation of the balloon.

The accompanying illustration of the apparatus used near Arras shows the machine responsible for the French winnings near this point. This car carries a reel holding about five thousand feet of cable, and is connected by gears and friction clutch to the main shaft of the motor, which gives perfect control of the balloon in any position. It can be maneuvered with great facility—either following along the front, retreating or advancing at the will of the operators. The gas generating device is most compact and effective, filling the balloon in a very short time. The car is also equipped with searchlight, electric generator, telephone and wireless instruments. The balloon at Arras was splendidly equipped, but, unfortunately, cameras were prohibited, so a small sketch is all I was able to obtain.

War balloons are small and of two types: round and cigar-shaped. The round balloon is most in use, but the cigar-shaped bag is said to have more stability. The baskets, or cars, of these balloons are usually occupied by two men, one to make observations, while the other communicates with the staff below. The telescope covers a range of fifteen or twenty miles, and shows very clearly the maneuvers of the enemy and the effect of the artillery fire of both sides within that radius. All information is at once communicated to the commander, who issues his orders accordingly, by means of messengers on horses or motorcycles.

In many instances the general himself goes up in the basket to make observations, or to direct the artillery fire from that point. Movements in the enemy's trenches can be watched, and the artillery fire directed either from the ground or from the air. Information may be signaled from the balloon either night or day. Thus special information and instructions may be sent immediately to the officers of any command within a radius of six or even eight miles.

Needless to say, these balloons are hunted by the German aeroplanes, and this necessitates French air patrolmen keeping a close lookout for hostile Taubes while balloons are in the air.

These combination balloon and automobile observatories have proven so successful that a great number are under construction at the present moment. The perfection of these air sentinels is only another phase of the rapid strides being made in the science of war.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Thunder at Sea

To the Editor of the SCIENTIFIC AMERICAN:

I have read your recent article concerning "Thunder at Sea" and wish to relate a personal experience I have had.

In June, 1907, I left port Talbot, England, on a sailing vessel bound for Taltal, Chile. While crossing the line (equator) about three hundred miles off the coast of South America we had a very severe thunderstorm, thunder, lightning, rain in torrents, from 8 P. M. until about 4 A. M. the next morning, continuously. I wish to mention, though, that this is the only time that I *remember* thunder at sea, and I remember this only on account of its violence; in fact, it was the most violent I ever encountered in any part of the world. We were told to keep our eyes closed and our ears protected with cotton. But the lightning did not strike the ship, although it was above our heads all of the time.

Pensacola, Fla. HERMANN T. MICHELSEN.

Cipher Codes

To the Editor of the SCIENTIFIC AMERICAN:

I have been seeing for some time in your paper different methods for secret codes in transmitting messages in war time.

I thought maybe the following would be of some interest to your readers because of its simplicity and being impossible to decipher unless the code is known.

Suppose this message was to be sent:

"The enemy are in full retreat. Strike now." And suppose we take this for our code, "87921."

Taking the letter "t," we count eight letters from same, for instance, u v w x y z a b. When we get to the end of the alphabet we start over again with "a."

Therefore our first letter in our code is "b." Likewise seven letters after "h" is "o," and "o" is our next letter in the code. Continuing thus, we have the following message:

"Bongomthcsmpwhvtsaguzljvtbyrmfvvf."

As will be noticed, all the words are run together.

Now, of course when you get to "1" in our code we start again with 87921879 and so forth.

Poe's method of deciphering would be worthless here since no letter is the same throughout the message. "E" in "the" is "N" and "E" in "enemy" is both "G" and "M."

Since any numbers can be used and changed at a moment's notice and no preliminary preparation to make for deciphering message (which is done by counting backward), this code seems to be very simple yet quite impossible to decipher without having code numbers. There are over a million different combinations that can be used. H. A. DARNELL.

Memphis, Tenn.

[The system described is one rather widely used. It is decipherable. See Gross's "Handbuch fuer Untersuchungsrichter," in which this and other cipher codes are discussed.—EDITOR.]

Color Music in Australia

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of the SCIENTIFIC AMERICAN dated April 10th I have read with great interest the article on "Color Music; a New Art Created with the Aid of Science," by Mr. Harry Chapin Plummer, and the admirable details which you give lend additional interest to me, as a student of color music. As your admirable journal has such a widespread circulation throughout the world, this article should have a very material effect in stimulating interest in this new art.

There is one point, however, that I would ask you, in fairness to me, to correct, and that is in the last paragraph of the article in question, where you mention that "this is the first time that color music has been demonstrated on a large scale to the public."

In this connection I would mention that we had a color music concert in the Sydney Town Hall on December 21st, 1912. We had a most interested audience of from two to three thousand and the concert attracted a very great deal of attention in musical circles. Prior to that, in November, 1912, a demonstration was given in Paling's Music Rooms to a crowded audience; and still earlier, in June of the same year, a demonstration was given in Greenwich, also to a crowded audience.

Since then I have progressed very considerably in developing the idea, and a little over a year ago, when visiting England, I had the privilege of a long interview with Prof. Rimington, when he expressed pleasure at our being able to compare notes.

As this matter is a hobby of intense interest to me, I may mention that I have had built a miniature theater to enable me to give private demonstrations of color music, and the new instrument which I am at present working on is almost completed.

Sydney, Australia. ALEC B. HECTOR.

The Small Inventor and the Inventors' Board

To the Editor of the SCIENTIFIC AMERICAN:

Without attempting to discount in any way or degree the tremendous importance to the nation of the proposed advisory board of celebrated inventors whose splendid collaboration cannot help but prove of enormous benefit to the country, I want to remind you of the large army of humble inventors of no national renown whose contributions to the fund of useful knowledge have not brought them any great reputation, although they may be of much practical importance. One of the Lincoln stories makes him say that "The Lord must have loved the common people because he made so many of them," so we may deduce the love of Deity for the common ordinary inventor. Emerson in his poetical colloquy between the mountain and the squirrel makes the squirrel respond to the boast of the mountain in this wise:

"Talents differ: all is well and wisely put.
If I cannot carry forests on my back,
Neither can you crack a nut."

Manifestly the inventive talents also differ, and our hopes from the inventive quarters need not be confined to those whose successes have made them pre-eminent in their chosen fields, for while they may carry the "forests" of offensive and defensive development on their backs, there will be many nuts to be cracked by the horde, the multitude of less prominent inventors whose contributions will doubtless be of much advantage to the nation. Possibly the inventive contributions may be in the way of accouterments, ordnance, the solving of transportation problems, or in some other of the many directions in which slight or revolutionary improvements may benefit the military and naval service.

A CONSTANT READER.

Fifteen-inch Versus Fourteen-inch Naval Guns

To the Editor of the SCIENTIFIC AMERICAN:

In one of the daily papers there appears a statement that eight 16-inch, instead of twelve 14-inch guns, may be mounted on the battleships "Pennsylvania" and "Oklahoma." As far as I am aware, the SCIENTIFIC AMERICAN has not as yet committed itself on this question, and as a layman, greatly interested in naval construction, I wish to suggest that it may be able to do the country great service by favoring the substitution.

If it is true, as Admiral Fletcher claims, that the present American Navy is equal to that of Germany, this equality must be credited to the past policy of American naval designers, in mounting guns at least equal in caliber to those of other navies at the time; whereas all the German pre-dreadnoughts are equipped with guns of inferior caliber. Let us not abandon this policy now. Germany and Great Britain are equipping their latest dreadnoughts with 15-inch guns. There can be little question but that the 15-inch gun is to become the standard, as the 12-inch gun was the standard for so long in practically all the navies of the world. Similarly, it is fair to presume that its powder charge and range will grow until another increase in caliber is necessary. Whatever apparent immediate advantage there may be in a smaller caliber gun with flatter trajectory and greater rapidity of fire, will soon disappear, and we will find ourselves in the present position of Germany—our older ships unable to take the first line, because in the race of naval development our designers have been at a disadvantage on account of our commitment to a gun of inferior caliber.

A battleship's usefulness is as a member of a fleet throughout a period of fifteen or twenty years. If it is effective only in a class by itself or against ships of a certain date, its main usefulness is lost. When we design a battleship, we should look at the period during which it is to be in commission, and the gradually changing fleet which it must help to compose. The "Pennsylvania" and the "Oklahoma" should be designed as much to fight against in opposing fleet mainly of 15-inch-gun super-dreadnoughts in the year 1920, as against a mongrel fleet of 12- and 13½-inch dreadnoughts in 1916. When a growth in the range and power of guns is certain, we may properly exaggerate gun power beyond what is needed to cope with ships now in commission. If this is considered extravagant to-day, in that a greater number of more rapid-fire guns sufficiently powerful for the present could be obtained for less money, it will prove economical to-morrow, when we find our older ships still useful in the first line.

Heretofore we have pursued what has proved to be an exceptionally wise policy. At present the reasons for it are more potent than ever, and we should not abandon it now. If our Ordnance Department is able to design a satisfactory 16-inch naval gun, by all means let it be mounted on the "Pennsylvania" and the "Oklahoma." SYDNEY LOMBARD SAYRE.

Chicago, Ill.

Privates VanNess Merle-Smith and J. G. Milburn, Jr., seated on the armored truck at the Military Instruction Camp at Plattsburg.

Capt. Halstead Dorey, U. S. A., in command of the Business Men's Camp.

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Private Mitchel (John Purroy Mitchel, Mayor of New York).

Major-General Leonard Wood, U. S. A. (right) and Col. Edwin A. Root, U. S. A., at the Business Men's Camp, Plattsburg.

The Business Men's Training Camp at Plattsburg

A Spontaneous Movement of United States Citizens for Self-Defense

By the Editor

REMARKABLE in many ways is the gathering of business men for a month's military training at the camp of instruction for Regular Troops at Plattsburg, New York. It is notable for the large number of men, 1,250, that have assembled there at short notice to learn the soldier's drill and duty. It is remarkable in the purely voluntary nature of the movement, these men having come from all over the United States of their own volition and without any solicitation whatsoever from the State or Federal Government. It is notable also, in the zeal and the serious purpose with which they have entered into the life of the common soldier, submitting to his hardships and applying themselves successfully—with amazing success in fact—to the mastery of the routine and duties of a soldier's life.

It is not, however, in these respects that the great significance of this movement is to be found; rather, we must look upon it as the expression of a deep-seated conviction in the minds of a large and widely-representative body of United States citizens of the fact that the terrific upheaval in Europe has within it a grave menace to the future peace and security of this country, coupled with an equally clear recognition of the fact that this country is to-day absolutely unprepared to defend its rights, its liberties, and its political and moral principles, should it be attacked by one of the great foreign powers.

The writer has just returned from a visit to Plattsburg, which he made for the purpose of gaining personal impressions, at the firsthand, of the motives which drew the men to this camp and of the spirit with which they are carrying on their work. He called upon and chatted with many of the privates in their tents when the men were off duty, and it so happened that his first visit was to a tent which contained the Mayor of New York city, an ex-Ambassador to France, a leading physician, a well-known multi-millionaire, and others of national and international reputation.

On stating that he had come to camp in the endeavor to get at the true spirit and meaning of the movement, one of the group said with great earnestness, "we hope that you will tell the people of the United States first and foremost that this is neither a rich man's junket nor a junket of any kind whatsoever, but that we have come here as United States citizens who realize that we are confronted with a grave crisis in our national history and are determined to do what we can, ourselves and by the force of our example, to wake the country up to a sense of its present unpreparedness." That expresses the spirit of the camp very truthfully, as I found in conversation later at the camp mess or at opportune intervals between drills and other duties.

The inspiration, the original starting point of the movement, was the profound impression made upon two or three prominent Americans, who were in France when Germany made her rush through neutral Belgium and was arrested and turned back at the Battle of the Marne. The full meaning of aggressive militarism, as shown by that sudden and unprovoked invasion, raised in the minds of these men, as it was bound to do, the question of the security of their own native land; and on their return to New York, one of them, learning of the students' camp movement, talked the matter over with his friends and found that they, like himself, were fully alive to the undefended condition of the United States, and were anxious to do what they could to awaken the country, and get its citizenry to wait no longer upon a Federal Government which had taken no steps whatsoever since the opening of the war to put the country in a state of reasonable military security. They then got into touch with Capt. Dorey and Capt. Johnston, aides to Gen. Wood, and stated that they thought they could get together sufficient men, say from 150 to 200, who would be only too glad to go into camp, somewhat on the student's camp lines, and take intensive training for about a month. The movement "caught on"; committees were formed in New York, Baltimore, Philadelphia, and Boston, and the originators of the movement found that in all these cities, and indeed throughout the whole country, the business men of the community were ripe for just such a movement. The outcome was the formation of the present camp of 1,250 men at the Camp for Military Instruction at Plattsburg.

This splendid movement is one of the most promising fruits of the work which Major-General Wood has been doing now for some six years past in endeavoring to awake the people of the United States and its Congress to a realization of the fact that the military defenses of this country are altogether inadequate. In his report as Chief of Staff and within the limited range of opportunities for public speech which are afforded to military officers, he has performed a patriotic service, the value of which is only now becoming understood. No one realizes the horrors of war so fully as the military officers of the United States, and the writer can state, after somewhat lengthy and close personal knowledge of Gen. Wood, that he has met no officer of our army who is a more earnest advocate of peace with honor and security. The Students' Camp, this camp for business men at Plattsburg, and the many others of a similar character which will inevitably be formed in the future, owe their success largely to his advice and guidance. More applications have been received than could be accommodated in the present camp, and at the time of the writer's visit, the General stated that about 300 applications had been received in New York within the last two or three days for another camp, and at that time it looked as though there would be sufficient men to warrant the formation of a second camp for a month upon the same lines as the present one.

The armed and armored motor car at Camp Plattsburg.

President Wilson has recently sent his sympathetic regrets at his inability to avail himself of Gen. Wood's invitation to visit the camp. The President's letter is as follows:

"My Dear Gen. Wood:

"I have followed, as well as I could at a distance, what has been done at Plattsburg and have followed it with the greatest interest. I think all concerned ought to be congratulated on the success of the experiment. Unfortunately it will not be possible for me to visit the camp. I find that I must lead a very narrow round in order to keep in constant touch with public matters of the first importance. It would give me real pleasure to visit the camp, and I am unaffectedly sorry that I must deny myself the chance.

"Sincerely yours,

"WOODROW WILSON."

Secretary of War Garrison, Assistant Secretary of War Breckinridge, Gen. Hugh L. Scott, Col. Theo-

dore Roosevelt, and several others of national prominence will visit and inspect the camp in the near future.

The camp is located on a gently sloping ground on the borders of Lake Champlain. In every respect, down to the least detail, the lay-out of the camp, its equipment, rules and regulations and the daily life and drills and maneuvers of the regiment are exactly those which would obtain if the regiment consisted of soldiers of the regular army. Reveille is sounded at 6 A. M. and the routine of the day's work is pretty much as follows: Breakfast, 6:20 A. M.; drill, from 7:00 A. M. to 11 A. M. The men are back at camp at 11:30 A. M.; dinner is at 12 M. The men are out again at 1:30 for various kinds of drill, in which they are exercised until 5 P. M. There is a drill with music by the band from 5:30 to 6 o'clock, when the men have supper. At 7 P. M. the whole regiment groups itself in a sort of natural amphitheater in the open, when they hear a short lecture on some military subject, which lasts from 7 to 7:30 P. M. Lights are out at 9 P. M.

How the men handled themselves after only two days' drill.

At the Business Men's Military Instruction Camp. Preliminary instruction in the care and handling of the rifle.

Every evening at 7:30 the regiment attends, in the open, a lecture on some military subject.

Col. Glenn, chief of Staff, stated to the writer that the proficiency acquired by the men, considering the short time they have been in camp, was truly remarkable, and is to be explained on the ground of their intelligence, zeal and fidelity. The average age of the men is about thirty-five, and there are not a few in camp whose ages range from forty to fifty—well preserved men who have kept themselves in good physical condition and are "doing their bit" with full efficiency. Fully 20 per cent of the privates are men of national and international note, and over 35 per cent of them are successful business men who are well-known throughout the country. It is interesting to glance down the roster of the regiment. It includes the Mayor of New York city, the police commissioner, the collector of the port, and an ex-police commissioner of the city. There are two members of the largest banking firm in this city. One notes in the list the names of an ex-ambassador and an ex-Secretary of State, and practically every profession is represented, generally by men who are widely known. In glancing through the roster one is struck also with the fact that practically every part of the United States is represented. Although the bulk of the men come from the large Eastern cities, such as New York, Boston, Philadelphia, and Baltimore, the writer noted the names of such towns as Syracuse, Princeton, Pittsburgh, Cleveland, Chicago, Ann Arbor, Galesburg, Ill., Manchester, Vermont, New Orleans, La., St. Louis, Mo.; Steamboat Spring, Colo.; Memphis, Tenn.; Piedmont, California; Eagle Spring, North Carolina; Aberdeen, Nebr.; Augusta, Ga.; and Norfolk, Va.

And what about Congress? Here is a great national movement embracing all classes of men from every part of the country, which is giving proof by positive self-denial and real hard work, that the country desires at once to be put in a state of proper defense. The people have spoken with a voice clear and unmistakable in its meaning; it is now for Congress to listen and by legislative act and by generous appropriations to render this movement permanent and thoroughly effective. The President, by his tactful and thoroughly appreciative letter, has set the seal of his approval upon the matter. It remains for the politician to forget his politics and realize that when the highest interests and possibly the very life of the nation are concerned, it is for him to forget his local prejudices and predilections and lend the whole of his influence to forward this great national movement for security and peace.

An Attempt to Measure the Free Electricity in the Sun's Atmosphere

IN an article bearing the above title, published in the *Proceedings* of the National Academy of Sciences for March, 1915, the authors, George E. Hale and Harold D. Babcock of Mount Wilson Solar Observatory, Carnegie Institution of Washington, begin by saying: "We have the strongest of reasons to infer the existence of free electricity in the sun."

The emission of negatively charged particles by carbon and other elements under the influence of high temperatures, friction, collision and ultra-violet radiation, on the one hand, and the preponderance of whirling negative electrons indicated by the intense magnetic fields in sun-spots, on the other hand, are mentioned as some of these reasons.

Stark's recent discovery of the effect of an electric field on radiation was utilized in the attempt to measure solar electricity. Stark found, for example, that the *Hα* line of the hydrogen spectrum, when generated in an electric field of 28,500 volts per centimeter and viewed across the lines of electric force, is resolved into a central component, polarized at right angles to the field, and two outer components, polarized parallel to the field. Hence, the total width of the resolved line may be varied by turning an interposed Nicol prism so that it transmits, or cuts off, the outer lines.

Now, the authors found the hydrogen lines weakened and narrowed in their photographs of sun-spot spectra, and they could not attribute to the Stark effect the general and marked widening of lines near the sun's limb, which was discovered at Mount Wilson some years ago, because these lines cannot be reduced by a Nicol prism to their normal width. In order to determine whether this widening is due in any degree to the Stark effect, a research was conducted by the most refined methods, but no appreciable difference in the width of the *Hα* line in the spectrum of the second order was produced by rotating the Nicol, although the probable error of the observations showed that a difference in width equal to 0.034 angström should certainly be discernible by the method employed. For the same line Stark observed a widening of 6.4 angströms in an electric field of 28,500 volts per centimeter. As the widening is proportional to the strength of the field, it follows that the intensity of the solar electric field at the point of observation cannot exceed 150 volts per centimeter.

The *Hβ* line gave a still lower value, so that it seems safe to say that the field-strength is less than 200 volts per centimeter.

This indicates, the authors conclude, "that in order of magnitude the electrical potential differences in the quiet solar atmosphere may not greatly exceed those in the lower atmosphere of the earth, where they average about one volt per centimeter."

Artificial Immunity Against Typhoid Fever

How Mortality of a Dread War Disease Has Been Reduced

By A. M. Jungmann

THAT immunity against typhoid fever as conferred by vaccination has been a highly successful measure of preventive medicine cannot be denied. An example of this may be seen in the armies fighting today in Europe. During the Franco-German war thousands upon thousands of soldiers died from typhoid fever. The freedom from this disease in the present conflict is due in part to a better understanding of the principles of sanitation, and a great deal of it is due to the work of the man in the laboratory. Years of painstaking laboratory research work has resulted in antityphoid vaccine, which is saving the armies of the world from typhoid fever epidemics.

During the year 1911 typhoid vaccination was made compulsory in the United States Army, and a striking example of the value of this vaccination may be seen in the fact that in 1912 the death rate from typhoid fever in the United States was 16.5 per hundred thousand and in the United States Army the rate was 0 per hundred thousand.

In 1896 the results of experiments in the prevention of typhoid fever by vaccination with *Bacillus typhosus* killed by heat were published by Wright of Netley, England, and by Pfeiffer and Kolle in Germany. But even before the publication of the results of these experiments, which oddly enough came out almost at the same time, another group of scientists had been engaged in a series of experiments which they hoped would result in a vaccine which would produce immunity against typhoid fever. Among these were Fränkel, Dunbar, Simmonds and Stern.

The use of this prophylactic measure was not entirely successful at first, partly because the amount of the dose was not properly worked out, and partly because the vaccine was subjected to too much heat. Leishman, who had been working with Wright, discovered that the vaccine had been superheated, and as soon as this fault was corrected a notable improvement in the results obtained was observed.

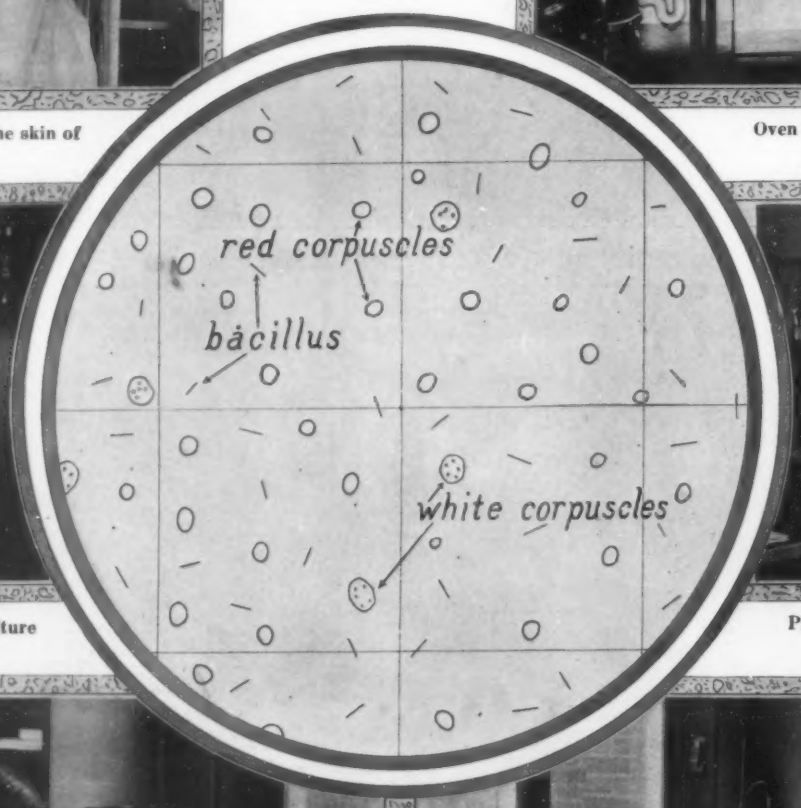
After an attack of typhoid fever certain substances appear in the blood of the patient which are known as antibodies. The presence of these antibodies renders the patient immune from a subsequent attack of the disease. It is the object of the vaccination to produce these defensive substances in the blood. It should be borne in mind, however, that the vaccine is a preventive of typhoid fever, and not a typhoid antitoxin, and that once the incubation period of the disease has begun it is too late for antityphoid immunization.

There have been a number of different methods employed in the preparation of the vaccine. Metchnikoff used a vaccine made of an emulsion of living typhoid bacilli, sensitized by antityphoid serum. This has been used successfully by both Metchnikoff and Besredka, a pupil of Metchnikoff. Russell in the American army, and Leishman in the British army, have employed a single strain of low virulence. In France a polyvalent[1] vaccine of as many as ten strains has been used. Chantemesse has made an antityphoid *serum* which has not won the approval of the others. This serum he obtained from horses.

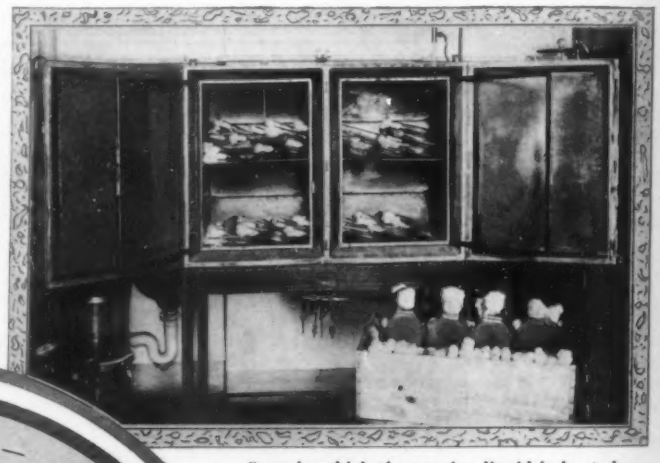
It is generally believed that it is best to use the sterilized single strain of low virulence which has been em-

[1] A mixture of several strains of typhoid bacilli derived from different sources, and believed by some authorities to be more effective in producing immunity.

Injecting the vaccine under the skin of the breast.



The number of bacilli and blood corpuscles in a mixture of blood and bacilli suspension liquid is counted by means of a microscope having a ruled eyepiece. The organisms and the blood cells are seen in square fields. It is a simple matter to count the red blood cells and bacteria in each field.



Oven in which the vaccine liquid is heated to kill the bacilli.

Sowing typhoid bacilli on the culture medium.

Placing culture tubes in a water bath.

Bottling the vaccine ready for use by physicians.

Gathering the crop of bacilli from the culture flasks.

ployed with such satisfactory results in the prevention of typhoid fever, both in England and in the United States.

The New York City Board of Health prepares a culture in its research laboratory which is very similar to that used by the Army. Persons desiring to be inoculated can do so free of charge by applying at the Department of Health. Almost two thousand were so vaccinated last year.

A laboratory culture of typhoid bacilli which has been artificially cultivated for a long time, so that it has lost much of its virulence, is employed in making the vaccine. Agar[a] which has been placed in Blake bottles is inoculated from fresh agar cultures. The bottles are then set aside in a temperature of 37 deg. Cent. to permit the bacteria to multiply. After twenty-four hours for growth has been allowed the bacteria are washed from the surfaces of the agar with a normal salt solution. Now comes the standardizing of the suspension. By this is meant counting the number of organisms per cubic centimeter so that the dosage may be accurately controlled. At first thought it seems well nigh impossible to count such minute organisms as these bacteria, but Wright devised a means which is accurate and at the same time strikingly simple.

Starting with the fact that there are 5,000 million red blood cells per cubic centimeter Wright evolved a method of counting the bacteria by comparison. A capillary tube is marked at a convenient point with a wax pencil, then from a finger prick a drop of blood is sucked up onto the tube to the mark. Then the same amount of bacterial suspension is drawn into the tube with an air bubble between the blood and the bacterial suspension. Next the two fluids are ejected from the tube onto a glass slide and are thoroughly mixed by being drawn into the tube and expelled onto the slide a number of times. The mixture is finally thinly spread on a number of slides in the ordinary manner of making blood smears. The smears are stained and examined with a microscope having a ruled eye-piece. In looking through the microscope the organisms and the blood cells are seen in square fields. It is a very simple matter to count the number of red blood cells and the tiny straight bacteria in each field. After a number of fields have been counted the number of bacteria per cubic centimeter can be calculated.

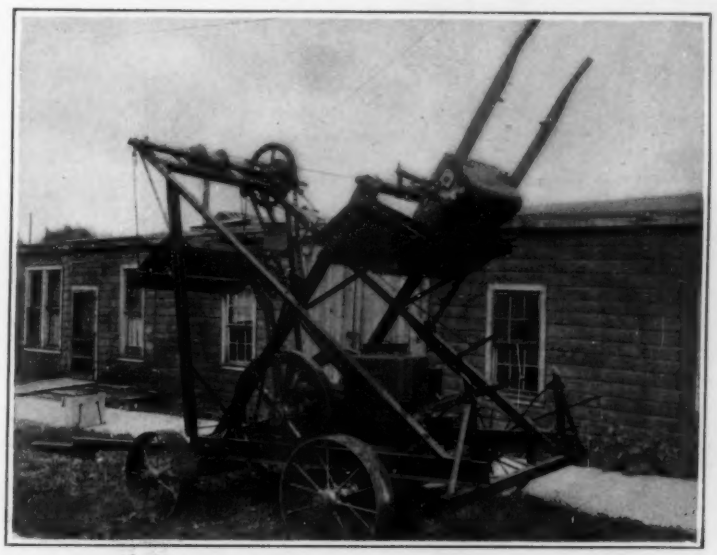
When the proportion between the number of bacilli and blood cells has been determined the suspension is heated for one hour at 56 deg. Cent., which kills the bacilli. The matter of heating is of the utmost importance. It was not until the exact temperature for the purpose of killing the bacteria was determined, as well as the length of time the suspension should be heated, that the vaccine attained its present success.

After the heating process comes the test for the sterility of the suspension. This is accomplished by inoculating sufficient amounts into media, and incubating these under both aerobic and anaerobic conditions. When the sterility has been indisputably determined by the absence of any growth 0.25 per cent of carbolic acid is added to the suspension, which is diluted with 0.25 per cent carbolic acid in normal saline solution so that one cubic centimeter contains the appropriate dose.

Now that the vaccine is ready for use it is bottled for distribution. Some is put up in liter bottles and some is put in sets of three small bottles, each set comprising the three doses required for inoculating a person against typhoid fever. The vaccine is kept in a refrigerator until it is used.

When antityphoid vaccination was first introduced it was generally believed that a single inoculation was sufficient to render the subject immune. But before long it was found that one dose gave insufficient protection. The accepted practice to-day is to administer three inoculations at intervals of from seven to ten days. The first dose for an adult is 500,000,000 bacilli, while the second and third doses consist of 1,000,000,000 bacilli. It has been found that persons who are vaccinated at about four o'clock in the afternoon suffer little inconvenience, as the reaction takes place while they are in bed. It is well for business persons to receive the injections on successive Saturdays. The fluid is usually injected on the outer surface of the arm at about the insertion of the deltoid muscle. Some physicians inject the vaccine under the skin of the chest wall. The dose administered to children is graded according to the weight of the child. For example, a child weighing fifty pounds would receive one half the dose given a grown person.

Whatever discomfort caused by the reaction subsides in twenty-four hours. Sometimes the reaction is very slight, consisting merely of a tenderness near the site of the injection, and again it may consist of headache, malaise and a rise in temperature several hours after the inoculation. In only one per cent of the patients injected has a more severe reaction been observed. But neither the local nor general reactions are of any moment except for the discomfort they produce. No relation has been found to exist between the severity of the reaction and the amount of immunity produced.



Loading loose material by gasoline power.

It has been commonly taught that an attack of typhoid fever renders the subject immune from the disease for life. But this is not a rule without exceptions. Occasionally a person suffers a second attack of typhoid fever. The immunity conferred by vaccination has been shown to last from two to four years. If, as has happened, in a few cases, a person who has been vaccinated against typhoid fever has contracted the disease, it is really no more strange than the case of a person contracting the disease a second time when the first attack is supposed to render him immune for life.

That vaccination gives absolute immunity is not claimed, but that the chances of infection are reduced to a minimum among vaccinated persons is obvious. It has also been noted that when a vaccinated person becomes infected with the disease the attack is much more mild than in the instance of unvaccinated persons.

Vaccination appears to protect against the ordinary causes of infection. That is to say, it protects against the average dose of infectious material; but it is not thought that it confers absolute protection against excessive amounts. In the case of persons who are exposed for long periods of time to exceptionally large doses of typhoid bacilli, such as in epidemics, the immunizing powers of the vaccine may be nullified to a certain extent. But even in such extreme cases the vaccinated persons who contract the disease stand a much better chance of recovery than do the unvaccinated ones.

[a] Agar is the substance used in laboratories for the cultivation of bacilli.

Moving Dirt With Gasoline

A NEW machine for excavating cellars, digging ditches, and loading manure has made its appearance. Gasoline furnishes the power. The machine is quite simple, consisting of a portable frame in which is mounted a 9 horse-power gasoline engine. Power is transmitted from the motor by a drive chain to a drum at the top of the machine, on which a 50-foot cable is wound. A slip scoop at the end of the cable carries the dirt from the pit or basement at any angle and delivers it into the wagon at the opposite side of the machine, with approximately the speed and efficiency of fifty men.

The loading part of the machine is in no way complicated. When the loaded scoop reaches the machine, the cable draws it into a steel holder on the end of a pair of lifting arms, which elevate the scoop, dirt and all, and empty it into the waiting wagon. A wagon can be filled in less than five minutes. The scoop is automatically returned to the ground after unloading, by the release of the friction clutch that conveys the power to the hoisting drum. The operator controls the machine with two levers—the power control and the clutch lever.

It is claimed that with a machine operator and two men on the scoop, 175 yards of earth can be excavated in a day, and on tests the amount removed has exceeded this.

The contrivance is compact and light and can be moved by two horses, and it occupies only a little more room than a common farm wagon.

The farmer may profit by this invention, as may the contractor. His open ditches may be dredged or his manure saved, both of which, in the economies of agriculture, will mean a greater showing on the profit side of the ledger.

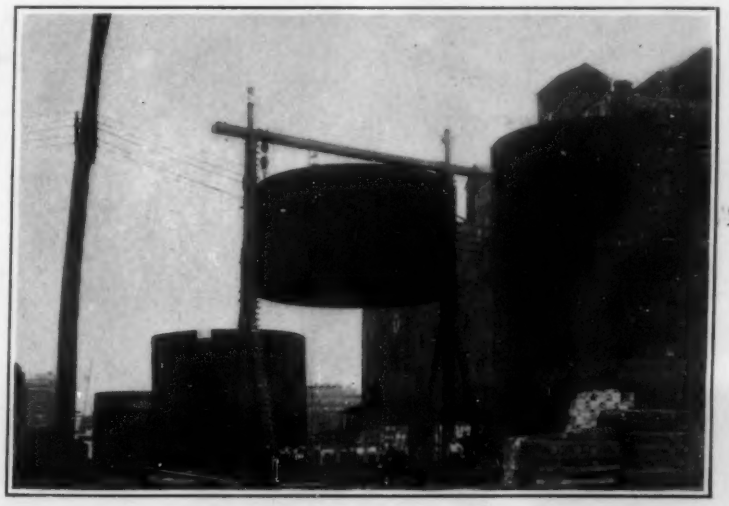
Moving Large Steel Grain Tanks

THE accompanying illustration shows the method employed in moving a number of large steel grain tanks at Chicago. The work was done in connection with the removal of a seed plant, from a site which is to be used for a railroad terminal, to a new location near the drainage canal, five miles away.

The plant included 22 steel storage tanks 60 and 40 feet high and 30 feet and 40 feet in diameter, weighing 40 to 50 tons each, and as these were in good condition it was desired to move them to the new plant.

It will be noted that the tanks were covered with conical tops supported on light radial trusses. A timber gallows frame was built, large enough to straddle a 60-foot tank, with two sets of hoisting tackle on the crossbeam. This was set up over a tank, and the hoisting hooks attached to two sling plates bolted to the top of the tank. Then the rivets of the middle circular seam were cut out by hand, and the upper half of the tank was lifted by the tackle. The lower half was raised by jacks sufficiently to allow of placing under it four heavy timbers, with blocking and wedges to support it at various points.

Finally under the supporting frame two lines of timbers with planking were laid, forming roller runways for the wooden rollers used in moving buildings. The lower section of the tank was then hauled out by a hoisting engine, the block of the the hauling rope being hooked to a bridle attached to the two side timbers of the supporting frame. There was a similar frame built for the upper section of the tank which was lowered upon it. These frames remained under the tanks throughout their removal. Each section of tank was held in shape by an interior frame of four timbers, with blocking between these and the tank shell.



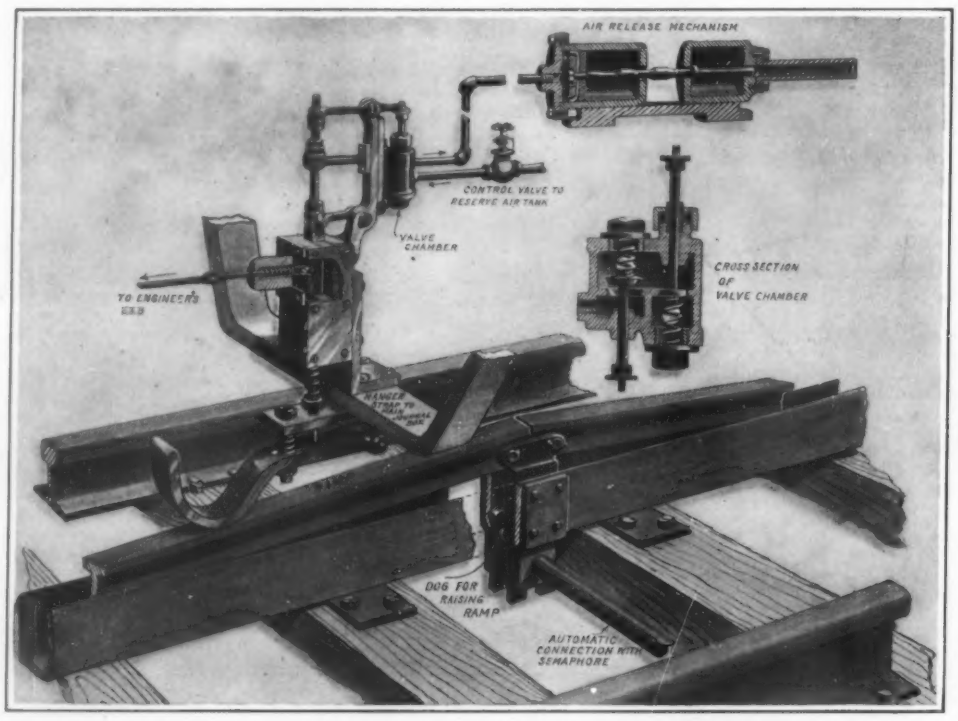
Dividing a grain tank into sections preparatory to moving it.

There were also interior ties of wire cable attached to threaded rods, which passed through rivet holes and were secured by nuts. A double-track roller runway was built through the yard to the river bank, and the tank sections hauled on this to the deck of a large scow, which accommodated three sections. The scow was then towed up the river and the drainage canal to a point near the new plant. A roller runway, supported on piers of blocking, was extended from the deck to the bank, and the tanks were hauled off by a horse winch.

A New Type of Automatic Railroad Stop

SOME trials were recently held on the Central Vermont Railway in the presence of a number of engineers, firemen, trainmen and railway officials in order to ascertain the efficiency of a novel train stop invented by George W. Brownell of St. Albans, Vermont. While it was impossible to place a main track at the inventor's disposal, with the result that high-speed tests could not be made, nevertheless very encouraging results were obtained at speeds of 25 to 35 miles per hour. The train stop never failed once. When traveling at 20 miles an hour the train was brought to a halt in about 75 feet after the throttle of the locomotive was closed. At a speed of 25 miles an hour with the throttle left wide open the train was brought to a standstill in 135 feet and 3 inches. Trial after trial was made at the maximum speed possible (25 miles an hour), but in no case was a distance of 137 feet exceeded before the train was brought to a stop.

These tests were made with a locomotive hauling a train of eight cars. Additional trials made with a locomotive hauling 27 cars and with a train pressure of 75 pounds, resulted in automatically tripping the valves of the last car in about 2⅝ seconds. The most satisfactory test of all was one made with a locomotive hauling 17 cars and running 35 miles an hour, in which test the train was stopped in about 2½ car lengths with the throttle wide open.



An automatic train stop which has been tested on the Central Vermont Railway.

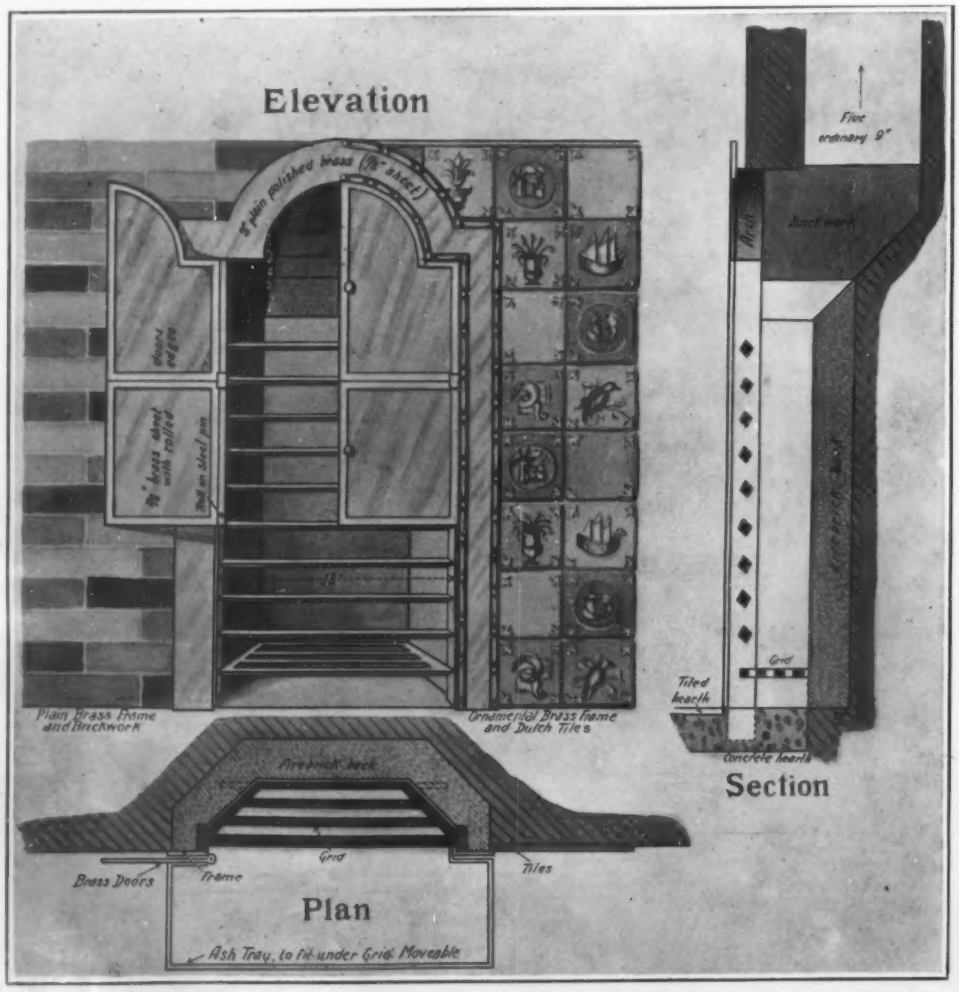
The accompanying illustration pictures the essentials of the Brownell system. As in all railway stops, no matter of what type, part of the operative mechanism is located on or near the roadbed and the rest on the locomotive itself. In this particular instance the roadbed portion of the apparatus consists of a ramp located between the regular rails. The ramp is composed of two sections hinged together and operated by an electric motor, which, in turn, is connected with the semaphore motor. When the semaphore motor is thrown a dog automatically raises the ramp at its hinged portion, as the illustration clearly shows.

The portion of the apparatus on the locomotive consists of a tripper located between the driving wheels and bolted to the main driving journals, so as to insure a constant position. When the track is clear and the semaphore signal is in its normal or "safe" position, the ramp lies flat, so that the tripper can pass over it without touching it. But as soon as the semaphore is thrown the ramp is lifted to the position shown in the illustration with the result that the tripper rides upon it and actuates the train stopping mechanism.

As the tripper thus rides over the ramp, it lifts a vertical rod to which are attached levers which operate a double set of valves. The vertical rod, when lifted, is held by a catch until released by the engineer. As the valves are operated by the lifting of the vertical rod air is allowed to pass from the main reservoir into a small cylinder, the one closing as the other is opened, the action being such that air cannot escape into the open. When the operation is reversed, in other words, when the brakes are released, the first-mentioned valve closes, thus preventing the air from passing to the cylinder and the other valve releases the air from the cylinder.

As the air thus passes back and forth, a piston in the cylinder moves correspondingly. Attached to the piston is a piston rod which extends to another chamber communicating with the train or brake line. Where it enters the chamber the piston forms a valve, which, in normal position, closes an opening larger than the piston rod. Two or more collars are located on the piston at equal intervals, so that as the rod is forced inward air is allowed to escape from the train line until the first collar enters its opening. When the collar passes through the opening only enough air is allowed to escape to keep the train line pressure at the point to which the space between the valve head and the

(Concluded on page 188.)



Design for an efficient smokeless grate for domestic heating.

Efficient Smokeless Grate for Domestic Heating

AT a recent meeting of the Royal Society of Arts, in London, Augustus Vernon Harcourt, F.R.S., read a paper on some investigations he had made on the subject of domestic grates, and their heating capacities.

In the construction of a grate to yield as much radiant heat as possible from the fuel consumed, certain principles should be observed: (1) The face of the fire should be vertical, so that the chief radiation should be horizontal, not directed upward toward the chimney and the ceiling; (2) the bars should be as slight as is compatible with sufficient strength, and as wide apart as will suffice to prevent more than an occasional ember falling out; the reason is that the bars do not reach a red heat, nor radiate so much heat as an equal surface of the fire behind them, and to the extent of the difference they act as screens; (3) for a similar reason the fire should be narrow from back to front. A space of 4 or 4½ inches between the back and the bars is enough; only the glowing surfaces which can be seen from in front radiate heat into a room, and lumps of fuel which hide other lumps and the red-hot firebrick behind them, act as screens, whether they themselves are dark or glowing; (4) air should pass in through bars in front, not through bars beneath; for the most vivid combustion occurs where the air and fuel meet. If this is at the bottom of the fire, much heat is radiated on to the hearthstone below, and helps to send a current of heated air up through the fire, promoting the burning of the coal, but not to good purpose; (5) to save the trouble of frequent attention and replenishing from a coal-scuttle during the day, and to avoid smoke, it is well to put in at once all the fuel the fire will need and to light it at top; (6) coke burns down more quickly than coal, and thus, especially with coke which has been "graded" and the light combustible coke from vertical retorts, the fire may reach its full heat near the middle of the day when its services are less needed than earlier or later. Control of the fire can be obtained by means of an iron plate put in when the fire is being laid, half-way up, resting on two or three lumps of coke only, that air may circulate underneath and prevent it becoming so hot as to ignite the coke beneath. When the fire is low the plate is pulled out, and the lower half of the fire makes a fresh start; (7) some means are needed for drawing up the fire when it is low. Either plates may be hung on one beneath the other, or folding doors may be arranged to close the upper part of the grate, and so concentrate the pull of the chimney upon the face of the fire beneath. Grates, of which an illustration is shown, have been constructed on these principles.

An Example of German Enterprise is found in a notice issued with a new edition of a German atlas which has appeared since the beginning of the European War. It states that purchasers of this edition are entitled to receive copies of the revised sheets showing changes in political boundaries resulting from the war, as soon as these have been settled.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of General Interest.

TYING DEVICE.—H. DE HAVEN, care of De Haven Mfg. Co., 50 Columbia Heights, Brooklyn, N. Y., N. Y. The invention relates to ties or bands tied around packages, packing boxes and other receptacles, and its object is to provide a new and improved tying device arranged to enable the operator to draw the band firmly around the article and to then securely fasten the ends together.

TOBACCO CAN.—J. D. BOYLAN, 504 S. 7th St., Ann Arbor, Mich. The invention provides a can especially adapted for holding paper cartons of tobacco, such as smoking tobacco, and wherein the can is provided with means adapted to be connected with the carton and with the can, for holding the carton in such position that access may be easily had to the tobacco.

SECTIONAL VIGNETTER.—D. COHEN, 508 Fulton St., Brooklyn, N. Y., N. Y. This improvement relates to sectional vignettes to be used in connection with a photographic camera. It provides an inexpensive vignetter, the curvature of which can be easily changed and the angular relation of which to the lens of the camera can be also easily varied.

WINDOW.—D. R. CALER, deceased. Address Mary J. Caler, Beaver, Pa. The invention relates to a type of windows provided with sashes adapted to slide and to pivot on a horizontal axis, and the invention more particularly refers to a window in which locking elements are movable laterally relatively to the vertical members of the sash, to lock the sash against turning, or to permit its turning, the said locking elements constituting weather strips.

FOLDING CABINET.—H. YAMASAKI, P. O. Box 326, Whitefish, Mont. The prime objects in this invention are to produce a cabinet arranged to be collapsed into small compass when not required for use, or to facilitate the storing, shipping or carrying of the cabinet; to provide a cabinet which may be quickly and conveniently set up for use or readily folded into collapsible form; and to provide a folding cabinet of light but strong construction.

STERILIZER.—OLIVE I. WILSON, St. Edward, Neb. The sterilizer is of the type employed in canning fruits at home or at the farm. The invention contemplates a sterilizer having the form of a vat to be heated, this vat being provided with means for preventing the jars or cans employed from becoming unduly or unequally heated, in such manner as to scorch or to burn the contents.

BAG LOCK.—H. SHPETNER, 139 Spring St., New York, N. Y. The invention relates particularly to a lock for bags, satchels and the like, and an object is to provide a structure which cannot be accidentally opened. Another object is to provide in a single structure a plurality of independent locking features which co-act for holding the frame of a bag together when the locking structures are in their locked position.

LIMB SETTING DEVICE.—DR. M. SCHNUG, Bonduel, Wis. In the present patent the invention has reference to the setting of fractures, as of the arm, and the main object is the provision of a simple though positive device for drawing the fractured members of a bone into normal alinement, and for maintaining the same therein.

LIMB SETTING TABLE.—DR. M. SCHNUG, Bonduel, Wis. The invention relates particularly to setting the fractured bones of the lower limbs, the femur, tibia, or fibula, and the main object thereof is to provide a table upon which the patient reclines, which is provided with means for drawing the fractured members of a bone into alinement and maintaining the same therein during the dressing, such as applying a plaster cast, splints, bandages, etc.

BAG HOLDER.—H. B. VANNOTE, 11 Vandewater St., New York, N. Y. The invention has particular reference to bag holders or supports adapted for holding mail bags in post offices, railway mail cars or the like. Among the objects is to provide a construction suitable for holding in a convenient position a considerable number of individual bags, the construction being of maximum simplicity and strength.

DRILL ROD COUPLING.—E. J. LOWE, Balboa, Canal Zone, Panama. The invention provides a coupling in which a rod has one or more recesses extending through an end, one side of each of these recesses being disposed obliquely for engagement by an obliquely disposed side of a tongue extending from a sleeve which is keyed to another rod which has screw connection with the first rod, while means provide that the sleeve may be rotated on the first rod to position the tongue at one of the recesses and with its oblique side disposed against the oblique side of said recess. When so positioned means provide for turning one of the rods relatively to the other to take up any slack occasioned by the wear.

PREMIUM CERTIFICATE.—R. E. GREGG, care of John H. Jones, 2 W. 45th St., Indianapolis, Ind. For the accomplishment of the invention use is made of redeemable coupons detachably connected with each other, one bearing conventional indications to constitute a purchaser's coupon redeemable for a valuable premium, and the other bearing conventional indications to constitute a benefaction coupon transferable by the purchaser to a third party and redeemable by the latter for a valuable consideration.

FUME AND SMOKE FILTER.—E. H. GAGNON, 1116 House Bld'g., Pittsburgh, Pa. This invention relates to improvements in filtering devices, and particularly to an improved construction for filtering the fumes and smoke from smelters and other similar devices so as to purify the smoke and fumes and to collect the solid matter in the smoke and fumes.

Hardware and Tools.

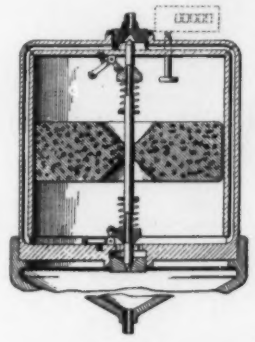
NUT LOCK.—W. C. GOSS, Marcus, Wash. The invention provides a nut lock key of simple form, having a novel means to engage the bolt; provides a key that may be readily applied, and which will securely hold the nut against turning; and provides a key, the bolt engaging means of which may be quickly released when it is desired to remove the nut.

Heating and Lighting.

AUTOMATIC TRAP.—E. R. HAWLEY. Address Thomas A. Williams, 211 Scott Bld'g., Salt Lake City, Utah. In this case the invention has reference to steam systems, as for heating and other purposes, and the main object is to provide means for automatically producing a vacuum in the pipes of such systems without the necessity for the pumps at present employed.

Machines and Mechanical Devices.

GASOLENE METER.—E. YOUNG. Address J. J. Young, care of Spokane Commercial Orchard Co., 214 Columbia Bld'g., Spokane, Wash. This invention has reference to liquid meters, and more particularly to a meter for measuring the amount of gasolene consumed by an automobile or other gasolene engine. One



GASOLENE METER.

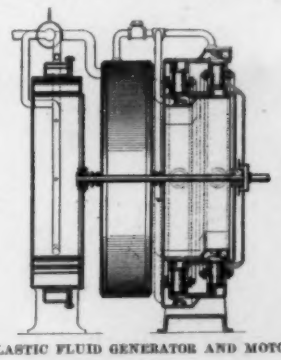
of the principal objects of the invention is to provide a meter adapted to be connected with a gasolene reservoir and the engine of a power plant, for measuring in units the amount of gasolene consumed by the engine.

WALL MOLDING STRUCTURE.—G. COUSINS, care of Chas. W. Dings, 173 W. 1st St., Oswego, N. Y. The purpose here is to provide mechanism for permitting a wall to be formed from plastic material capable of hardening, as, for instance, concrete, cement or the like, comprising connected inner and outer walls having a space air between them, and having means for supporting reinforcements for the walls.

REGISTERING MECHANISM.—M. IRION and A. E. MUELLER, 404 W. Market St., Louisville, Ky. This invention has reference to the registering mechanism especially adapted for speedometers or other instruments wherein it is desirable to reset the number wheels or indicating elements back to zero or initial position.

Prime Movers and Their Accessories.

ELASTIC FLUID GENERATOR AND MOTOR MECHANISM.—S. D. SIMMONS, 4228 Park Ave., Bronx, N. Y., N. Y. This invention relates to apparatus for generating elastic fluid from explosive mixtures for the purpose of supplying an elastic fluid turbine or rotary engine, although it is not necessarily limited to this use. The invention provides a novel motor of the elastic fluid type, which is capable of efficiently converting the energy of the elastic fluid into mechanical power, and also which is capable of ready reversal.



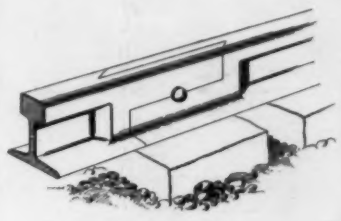
ELASTIC FLUID GENERATOR AND MOTOR MECHANISM.

INTERNAL COMBUSTION ENGINE.—J. F. BRICE, 60 Wall St., New York, N. Y. The invention relates to engines of the two-cycle type in which the explosive charge is compressed in the crank case, and the object is to provide improvements in this class of engines whereby regularity of operation throughout a wide range of speeds and under all variations of the throttle is obtained and the working chamber is completely scavenged of the products of combustion once in each revolution. Mr. Brice has invented another internal combustion engine which relates to the two-cycle type, and in which the explosive charge is compressed in the crank case, and such, for instance, as is shown in the application of Letters Patent of the U. S., No. 782,657, filed by him on August 2, 1913.

Railways and Their Accessories.

VALVE MECHANISM.—H. A. HATFIELD, Nogales, Ariz. This invention relates to improvements in valve mechanisms to be used on railroad cars. The object is to provide a device which is to be used in connection with an automatic triple valve for setting the brakes by increasing the train pipe pressure above normal.

RAIL JOINT.—J. D. MCCALL, McCall, Idaho. This invention relates to an improvement in rail joints, and more particularly in improved joints of the continuous rail type. One of the principal objects is to provide an



RAIL JOINT.

improved rail joint of the continuous rail type, of such nature that the rails are readily interchangeable and the ends of the rails so fashioned that low joints and spreading rail ends are eliminated.

Pertaining to Recreation.

ATTACHMENT FOR FISHING FLOATS.—S. W. DAVIS, 14 W. Ave. G, San Angelo, Tex. This invention provides an attachment that may be applied to known forms of floats; provides an attachment which may be permanently secured to the float and having means for the attachment and detachment of the line; and provides for the secure retention of the float on the line.

GAME.—N. H. ALBRECHT, care of A. J. Baldwin & Co., Dawson, Ga. The invention provides a game of war, in which a board is utilized upon which toy men and cannon are mounted, a set for each of the players, barricades being provided for protecting the men on each side from projectiles operable by the cannon, further obstructions being provided for the toy men and being operable by the players at will.

Pertaining to Vehicles.

COMBINATION CUT-OUT FOR ENGINE IGNITION SYSTEMS.—J. C. SIMS, 23 McKinley St., P. O. Box 255, Maynard, Mass. This invention refers more particularly to a combination device whereby no person other than the owner or employee can manipulate the cut-out when the ignition system is open-circuited, as when the owner or driver leaves his automobile in a public thoroughfare for any purpose, and hence the automobile cannot be stolen or used surreptitiously.

Designs.

DESIGN FOR A ROAD SIGN.—J. H. BEESON, Crawfordsville, Ind. The design shows a face view of a road sign comprising an upright, a horisontal and cross pieces, the first tipped with a starred shield and the last with starred arrow heads.

DESIGN FOR A LAMP SHADE.—G. C. LYNCH, 333 4th Ave., Manhattan, N. Y., N. Y. The principal feature consists of a silhouette design on a ground which is translucent to permit the light of a lamp to pass therethrough, for throwing the design into sharply distinct contrast.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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A New Type of Automatic Railroad Stop

(Concluded from page 186.)

collar has reduced it; otherwise it would fill rapidly to its normal pressure because of a filler hole located in the engineer's brake valve to overcome leaks in the train line. All this is equivalent to a first reduction by an engineer using his brake valve.

As the piston is forced in the same direction by the air entering through the double valves against a spring located in a guide at the outer end of the train line chamber, the first collar passes through the opening and allows the second reduction to take place. As many reductions are made as may be necessary to bring the train to a full stop. Hence the cars are brought to a standstill, not quickly (with consequent damage to the rolling stock and danger to the passengers), but easily. If, however, an emergency stop is desired, the apparatus can be modified to allow the piston to pass quickly through to an opening, much larger than the others, so that the air may escape rapidly from the train line.

In order to control the speed of the piston, a needle valve is located in the air pipe leading to the double valves from the main reservoir. Thus the piston is allowed to move slowly in one direction, but quickly when it is released. No part of the pipe leading to the release valve is closed. Hence the train line valve is closed almost instantaneously so that the train line regains its normal pressure and the brakes are released.

There is a psychological side to this apparatus which deserves attention. The inventor has proceeded on the principle that an engineer is normally a cautious man and that he may be trusted. Otherwise he would not be engaged for a very responsible task by his employers. If he runs past a signal for any reason and the automatic train stop begins to work, why not let him control the apparatus himself? Only a recklessly criminal engine driver would plunge on after the apparatus had started to bring his train under control. It is this feature which received the endorsement of the engineers on the Central Vermont Railway, who used the apparatus.

As soon as the engineer notices the first movement of the apparatus, assuming he has run past his signal, he may take control of his train and make his stop in the usual way. If, on the other hand, the engineer is disabled, the apparatus at once takes control of the brakes and brings the train to a full stop before the danger point is reached. This is accomplished by placing the ramp sufficiently far in advance of the semaphore so as to allow what may be called a running application of the brakes instead of an emergency application.

In order to prevent ice from jamming the ramp in winter, the ramp is contained in a trough which contains salt.

The Psychology of Baseball*

By Arthur Macdonald

THE motto of the famous old Oriole team of Baltimore, never to be excelled, was to do the unexpected. It is the same to-day. They were the originators of most of the fine plays we have now. The Big Four were McGraw, Jennings, Keeler, and Kelly. Keeler and McGraw developed the bunt. McGraw also was known as the "fouler off" to tire out the pitcher. Jennings could always be depended on to reach first base, either by making a hit or getting hit by the pitcher. Inside baseball was their hobby. Now it is the general practice. In the old games everyone starred for himself at the expense of the team; at present, the individual must play to advance the team.

Specialism has so developed that modern players are better on the infield, but weaker at the bat, yet they have no more speed or better curves than the old players. The modern infielders play rapid and glittering baseball, but they are no better

* Reprinted from the *American Physical Education Review.*

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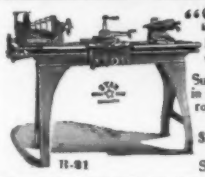

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field generals than those twenty years ago.

The modern outfielders, however, have not been so much specialized and so are more like the old players. Yet even here, according to the official records, the star players seldom or ever lead in fielding, and are frequently far down on the list. While modern basemen are more developed in defensive ways, they are not like the old-timers in batting. Base stealing is also inferior, owing to the increase of team work. The result is, many players will not do anything on their own initiative, or attempt to steal a base, unless told to do so; that is, the habit of following orders so much has required less individual brain work than in former years.

Signals.—In inside baseball playing of the modern type, signals are of the greatest value; they can be so manipulated that every player in the defensive knows exactly what kind of a ball the pitcher is going to pitch, and knowing the general tendencies of each batter, where he usually hits, the kind of balls he likes or dislikes, they can figure on what to expect and act accordingly.

Managers of Teams.—There are few managers who believe their teams will win pennants. It is seldom that more than three clubs can hope to win the pennant. Usually ten years are necessary to make a pennant-winning team, and it does not maintain its position more than three years before it begins to retrograde.

Comiskey, leader of the pennant-winning teams, says pitchers and conditions will win. Detroit and Pittsburgh put batting first. Chicago emphasizes team work, inside play, and base running. Boston has made speed prominent.

The great success of leading managers is a selection of men who will keep in condition. Discipline they must have. Managers would like more opportunity to study a player for a month or two before making a decision. But conditions force upon them more or less snap judgments.

One of the hardest problems for managers is handling the pitchers to get the right one for the opposing team. The pitcher is an artist, and has the characteristics of that temperament. When the White Sox of Chicago were crippled and only one pitcher was in form, the manager used him frequently to pitch an inning or half an inning, spreading him over his games. He came near winning the pennant.

Vividiffusion Experiments on the Ammonia of the Circulating Blood

IT is well known that the ammonia content of shed blood increases, even under aseptic conditions, but the source of the increase has remained uncertain.

Alice Rohde, of the Department of Pharmacology, Johns Hopkins Medical School, contributes to the June number of the *Proceedings* of the National Academy of Sciences a note on her experiences, undertaken to determine whether ammonia is formed in diffusable constituents, separated from the circulating blood by Abel's vividiffusion method. The apparatus was attached to the femoral artery and femoral vein of a dog. The liquid thus obtained by dialysis from the circulating blood showed no increase in ammonia after standing thirty-six hours, in which period the ammonia content of a sample of blood drawn at the close of the dialysis was more than doubled. The conclusion is that the slowly evolved ammonia has its source in non-diffusible constituents of the blood.

An Automatic Timer for Races

WITH a view to eliminating the factor of human error in timing a foot or other race, Alanson L. Fish of Flushing, N. Y., in a patent, No. 1,146,320, starts a stopwatch by electric devices energized by the discharge of the starter's gun, and stops it by a device actuated by the racer at the end of the course. When there are several racers, individual watches are provided, all started in unison by the discharge of the starter's gun, but stopped by the devices actuated by their respective or corresponding racers.

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